How Professional Development Impacts On Experienced Teachers' Perceptions Of Their ICT Practices

Lynette McDonald

B Bus (USQ) Dip T (QUT)

Submitted in fulfilment of the requirements for the degree of

Master of Education (Research)

Centre for Learning Innovation

Faculty of Education

Queensland University of Technology

August 2015

KEYWORDS

case study, educational technology, ICTs in education, information communication technology, professional development of teachers, thematic analysis

Abstract

Technology drives a range of changes within all levels of Australian schools. Teachers are increasingly required to use digital technologies as tools for learning, while also including technology in administrative duties such as recording attendance, reporting student's results and communication. This thesis examines two core issues: (1) experienced teachers' perceptions of their information and communication technology (ICT) practices and (2) how professional development (PD) courses have affected these practices.

This research project used a case study approach and focused on experienced teachers in one urban Queensland high school. Data was collected from experienced teachers in relation to their current ICT use through face-to-face interviews and an online survey.

This study's findings have important implications for the implementation of effective professional development in schools. The results have shown that the predominant use of ICTs by teachers in this school occurred outside the classroom and was generally in the areas of planning, resource development, communication and assessment. These teachers learned about ICTs using methods of professional development; however, this mainly occurred in their personal time due to other school-based priorities.

Teachers are at the forefront of ICT use in schools and teachers can be very influential in shaping a school's culture. Schools face many competing agendas and priorities in relation to literacy, numeracy and changing curriculum frameworks. Therefore, these innovative teachers face many challenges and barriers that can halt any improvements. School leaders and teachers are under increasing pressure to maximise their use of resources and effective professional development methods, which have the highest impact, must be identified and implemented.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signature:

Date: 23/08/2015

ACKNOWLEDGEMENTS

I would like to acknowledge and thank Bruce Burnett and Michael Dezuanni for their guidance, advice and support over the last three years. Your encouragement, leadership, supervision and intelligence have been outstanding.

I would like to recognise and give special thanks to Cathy Pfingst, Principal, for her regular and unfaltering wisdom, guidance, and most of all, invigoration and assurance when it was needed.

I would like to thank Megan Pozzi, at Queensland University of Technology, for her opinions and direction during this process. I would like to thank professional editor, Melissa Giles, who provided flawless copyediting and proofreading services, according to the guidelines laid out in the university-endorsed guidelines and the Australian Standards for editing research theses.

I would like to thank the teachers, particularly those who participated in the interview and survey. I am eternally indebted to you and in equal measure inspired by you. I am also motivated and thankful to the teachers I work with on a daily basis, both within my faculty and within the eLearning Committee, who have always had kind words of encouragement, have shown their support in countless ways and have been innovative with their use of ICTs in the classroom.

I would also like to thank my family and friends, particularly my children, Rhian and Jared for allowing me to undertake this project over the last four years and put up with many replies of 'Sorry I can't do that, I have to work on my thesis'. Your support has been immeasurable and is enormously appreciated.

Thank you to all of the other people who have shown an interest in my research and have offered kind words of encouragement and optimism as the final deadline approached.

Chapter 1 Introduction

This chapter outlines the background of the project, the context and purpose of the research and provides definitions of terms used within this thesis. The significance and scope of this research is provided, followed by an outline of the remaining chapters.

1.1 Background

1.1.1 Change agenda

In the same manner that technology drives change in how businesses operate and how people behave in their homes, it generates pressure on educational policy makers, and therefore, on teachers, to change. Every year, there appears to be a new agenda of change in schools, often referred to as an *explicit improvement agenda*. Such agendas require teachers to re-think strategies, adopt innovations and ensure that benchmarks are measured and achieved. Although the role of teachers remains one of facilitating a course of learning that is engaging for students, improvement agendas are influenced by other discourses, such as those about assessment, with the outcome to ensure that academic achievement goals are attained.

Many change agendas are present in our schools and currently there is a focus on data and standardised testing. In contrast to this agenda, many millions of dollars is being spent on technological tools in order to ensure that curriculum practices are preparing students for 21st-century lives and careers. Some schools have adopted take-home laptop models, while other schools are creating pods and labs of computers. These changes are now no longer optional and teachers are required to embrace technology. Research has shown that computers and technological devices alone do not improve the academic results of students or schools (Eng, 2005, p. 635; Hurd, 2009, p. 139; Somekah, 2006, p. 167). This is largely because many teachers use these devices at a simplistic level based on traditional pedagogy or do not engage with these new technologies. The goal should be for teachers to use new technologies to encourage higher thinking, creativity and collaboration, so that students have the skills to be ready for 21st-century workplaces.

Changes are guided by a combination of policies from government (federal and state) and from within the school. Federal government policies, under the banner of the Digital Education Revolution, (Department of Education, Employment and Workplace Relations, 2008), have seen schools receive significant funding since 2009 to purchase desktop and laptop computers for use with Year 9–12 students as part of the National Secondary School Computer Fund (NSSCF), which aims to increase the ratio of devices to students. The Queensland Government has developed programs in the form of the Smart Classrooms policy. For example, in 2007, all teachers in Queensland secondary and primary schools were provided with a personal laptop, based on the Computers for Teachers (C4T) policy.

1.1.2 Historical context of impacts and study site

This section outlines the historical contexts of impacts between 2000 and 2011 at the study site. I have been a user of technology in classrooms since beginning my high school teaching career in 1988. Since 2000, I have been chairing the eLearning Committee at my school, which, for many years, was a role that focused on managing the physical and financial resources of a computer network. Over the past few years, however, advances have been made in centralised networking environments, help desk support and the provision of more computers. This has allowed the eLearning Committee to focus on pedagogy and the professional development of teachers. The approach to professionally developing teachers was largely teacher-driven. Teachers at the school were required to write a Growth and Learning Plan to set goals and identify what professional development would help them to learn the desired skills. To date, no tracking of this professional development model has been carried out to ensure that the workshops being attended were successful in reaching these goals.

In 2008, C4T provided every teacher across Queensland with a laptop and most of the professional development sessions that were designed to help teachers learn how to use these devices occurred within schools. The introduction of electronic and online systems for attendance records, curriculum planning, reporting, notices, newsletters and email forced teachers to adopt technology in their daily duties and professional development was again offered to help teachers with this shift.

In 2010, the eLearning Committee was charged with ensuring that every teacher attained a minimum benchmark of ICT use, including word processing, presentation and email software, as well as use the Internet for research and inquiry. This goal was achieved by creating a mentor-based process and building ICT leadership capability across the school. In that year, approximately 97% of the school's teachers attained this benchmark. The remaining 3% were actively resistant or lacked the necessary skills.

In 2011, the eLearning Committee led and managed a group of teachers in a long-term collaborative professional development model to develop ICT use within the classroom. About 15% of the school's teachers nominated themselves to participate, partly motivated by the promise of increased access to devices and release from some classes. These teachers were already using ICTs in their classrooms, and with the rewards promised, there was little resistance to adopting innovations.

The long-term plan is to engage all of the school's teachers in the effective and efficient implementation of ICTs, and in some cases, to change their values and beliefs about how ICTs can be integrated into the classroom to benefit student's learning. Some of these teachers can see a direct benefit of using ICTs, but are not entirely convinced that technology provides an advantage. In addition, certain obstacles, such as access to equipment, technological barriers or a lack of time or priority, may prevent these teachers from implementing such changes. At this site, it is the most-experienced teachers who require additional persuasion to change their pedagogical practices in the area of ICTs. For the purpose of this research, an experienced teacher is defined as a teacher who has had at least 10 years of teaching experience in Queensland secondary schools.

1.2 Context

The impact that professional development has on experienced teachers' ICT practices has been identified and analysed in this study. This research is important because this impact must be clear in order to further support teachers and guide the future professional development programs. Given the large financial investment that has been made to develop and equip schools with infrastructure, it is essential that a

return on this investment is made. Technology alone cannot improve student outcomes, but quality technology use by a quality teacher can (Hattie, 2009).

The impact of professional development on experienced teachers' ICT practices can be viewed in four key ways:

1. Professional development might have had little to no impact on some teachers' practices because they have not engaged with technology and their practices have not changed.
2. Many teachers have noticed a basic impact of technology on their day-to-day methods. Professional development has changed their administrative and communication processes. These changes are evidenced by the use of electronic attendance records, electronic communications and word processors to develop unit plans, and integrating basic ICT skills into their classrooms (i.e. word processing and internet research).
3. Some teachers have already changed their practices so that technology is being used to enhance students' learning. They are using technology to encourage students to become critical and creative thinkers and learn in a global and mobile environment.
4. Some teachers have changed their practices to the extent that they are influencing and persuading other teachers to change their practices. These leaders are collaborating, mentoring and coaching other teachers and have embraced the professional learning networks that technology has helped to facilitate.

1.3 Purposes

The overall aims of the study were to increase our understanding of experienced teachers' current ICT practices and what impact professional development activities had on these experienced teachers. This increased understanding of the link between professional development and the impact that it has on teachers' practice will support teachers as they contend with an ongoing agenda of change.

This research specifically examines two questions:

1. **What are experienced teachers' perceptions of their current ICT practices?** This includes a self-reported identification of how ICTs are used by teachers to implement effective teaching and learning environments, which incorporates communication, administration, planning, implementation and assessment practices.
2. **What impact has professional development had on experienced teachers' ICT practices?** This includes an analysis of the different types of professional development, the teachers' attitudes and perceptions towards the professional development and the impact the professional development had on experienced teachers' ICT practices.

1.4 Significance, scope and definitions

Schools strategically aim to achieve a range of desired benchmarks in relation to students' outcomes. Given the amount of financial resources invested in schools to integrate ICT into the curriculum, it is essential that these funds are used efficiently.

Students have the right to experience a full range of educational learning experiences that prepare them for living, working and studying in the 21st century. Society demands that students have enhanced technological skills, and while some would argue that students have these skills regardless of their education, the research has shown that their acquired skills through social networking and internet use is primarily as a receiver of information (BECTA, 2008, p. 12; Scheuermann & Pedro, 2009, p. 19). Teachers need to ensure that students develop skills of creativity, critical thinking and communication, and ICT is one of the tools that can enhance the development of these skills.

Teachers need to be provided with quality professional development if they are expected to utilise the range of technologies available to them. As new forms of technology emerge, professional development also needs to evolve, so that teachers have the necessary skills and abilities to use them.

ICTs have not had the favourable impact on students' learning that many had envisaged; however, this is unsurprising given that technology is only a *tool* for learning and it is the teacher's use of ICTs that is paramount. Hattie's research (2009) shows that teachers have the biggest effect on students' learning. If technology is the tool, then combining an effective teacher with the effective use of

technology should result in effective learning. ICT should no longer be viewed as an add-on tool, gadget or device, but as an essential component of learning, and terminology such as *21st-century learning* should now simply be *learning*. However, teachers must be guided through a change-management process to develop their capability to use ICTs to benefit student's learning outcomes.

Research has shown that professional development models (Borko, 2004; Garet, Porter, Desimone, Birman & Yoon, 2001; Wells, 2007) in the past have not always resulted in a positive change to teachers' practice. To have any long-lasting change, professional development should be based on pedagogy and content, be collaborative, be engaging for teachers, be based on research and evidence, and offer follow-up and support. Identifying the impact that ICT professional development has on experienced teachers' ICT practices will allow a professional development plan to be designed that will transform pedagogical practices and enable ICT to be used as an effective tool for learning.

This research is taking place in one school, which results in two main limitations of applying these results to other school environments. First, the school does not operate a 1:1 laptop-learning environment. A 1:1 environment may result in different impacts on teachers and students; therefore, the findings from this study can only be applied to an environment with similar infrastructure. Second, the environment is also significant because it is a large suburban high school that is only 15 years old, and therefore, is not steeped in long-standing traditions. The culture of the school is still forming; however, the school achieves high academic results and it has a focus on academic achievement, results and data, as opposed to innovation, creativity and entrepreneurship.

ICT encompasses skills that a teacher may use in the course of their duties that include hardware, software as well as duties which are based on communication and administration. The term digital pedagogies, while currently used by Education Queensland to provide advice to teachers on how to implement curriculum within the classroom does not incorporate those skills used outside the classroom. In addition to this, the term digital pedagogies is not widely adopted by federal educational policies, in particular the *National Professional Standards for Teaching*, developed by the Australian Institute for Teaching and School Leadership (AITSL) (2011) or

Shape of the National Curriculum developed by the Australian Curriculum Assessment and Reporting Authority (ACARA) (2012).

Professional development is the most widely accepted term outlined in state and local policies. Education Queensland and Queensland College of Teachers both currently have policies that reference the term developing or development. In particular, *Developing performance framework* (EQ, 2012) and the *Continuing Professional Development Framework* (QCOT, 2012). The term professional learning was considered, however given it is not widely used at this particular site or within Education Queensland policies it was not adopted.

1.5 Thesis outline

The remainder of the thesis chapters are structured as follows. Chapter 2 contains the literature review. The first section examines ICTs in education, including the history of ICT use in education and the impacts, outcomes and teacher perceptions of these uses. The second section examines the professional development of teachers, including models and features, teacher attitudes and perceptions, and barriers that may prevent effective implementation. Chapter 3 outlines the research methodology, which is based on case study and thematic analysis. Chapter 4 presents the study's data and results. Chapter 5 contains an analysis of the results with reference to the literature. Chapter 6 discusses the major themes that became evident through the analysis. Chapter 7 offers conclusions, including the key findings, limitations and recommendations for implementing the research outcomes.

The research methodology outlined in this section was designed as a qualitative case study because the specific purpose of the research was to understand changes in experienced teachers' ICT practices at this site as a direct result of the implementation of ICT professional development methods.

Case study research, similar to all research, requires a theoretical perspective from which the case study will be approached. The specific individual theory proposed was Rogers' (2003) *Diffusion of Innovations* Theory, which identifies varying degrees of engagement and adoption of new practices. Tearle's (2004) *A theoretical and instrumental framework for implementing change in ICT in education* Theory analyses organisational aspects, such as corporate culture, work

team values and team dynamics and how these relate to the acceptance of innovations and a teacher's willingness to engage with professional development. Leaders' roles within the organisation and their impact on professional development implementation are also addressed.

Chapter 2 Literature Review

This chapter presents a literature review divided into two sections. The first section examines ICTs in education, including the history of ICT use in education and the impacts, outcomes and teacher perceptions of these uses. The second section examines the professional development of teachers including models and features, teacher attitudes and perceptions and barriers that may prevent effective implementation.

2.1 Topic 1: ICTs in education

This first section of the literature review begins with a historical account of ICTs in education beginning in the 1960s to what is currently occurring within Queensland schools. This is presented chronologically from pre-1980s, the 1980s, the 1990s, the 2000s and current.

2.1.1 Introduction

This is included to show how ICTs have been used by teachers in classrooms over many years and provides evidence that the evolution of use has taken place at a much slower rate than what has occurred in society. Also included are the positive and negative impacts on teachers' practices, teachers' perceptions and outcomes for students.

2.1.2 Pre-1980s

ICTs in society and education

Early innovators were beginning to see the potential that technology could have in business and industry in the 1960s. While this was having some impact on organisational and manufacturing practices in industry, the impact in schools was generally limited to administrative areas.

The origin of computer technology can be traced back to the early 1940s, when a German engineer developed a Z3 computer based on binary arithmetic; the first widespread commercial use occurred several decades later when the development of integrated circuits increased computer efficiency and reliability while reducing the cost (Bitter & Legacy, 2008). This innovation in the 1960s coincided with the first widespread use of computers in business and industry. In 1960, IBM released its

1400 Series machines primarily for the business market, and in 1964, university professors Kemeny and Kurtz developed Beginners All-purpose Symbolic Instruction Language (BASIC), which became a pivotal programming language used in many applications (Harrington, 2009, p. 40). Devices such as audio-cassettes (1962), the first hand-held calculators (1964), compact discs (1965), computer mice (1968), word processors (1972), ethernet cabling and laser printers (1973), and spreadsheet software (1978) were subsequently developed (Harrington, 2009, pp. 40–42). Bill Gates and Paul Allen founded Microsoft (1974) and Steve Jobs and Steve Wozniak founded Apple (1976), which revolutionised technology in society and education.

Computers were introduced into the university educational arena in the US in the 1960s, when students started using educational software (Coley, Cradley & Engel, 1997, p. 10; Kulik & Kulik, 1991, p. 75; Starkey, 2011, p. 2). The software in use was based on programmed instruction that required students to provide a simple response to stimuli, which was reinforced with either positive or negative feedback. In 1963, Stanford University developed a self-paced program based on computer-assisted instruction within its mathematics and reading courses. The focus behind these programs was based on the simple pedagogy of drill and practice, and writing, collecting and publishing information (Coley et al., 1997, p. 11; Starkey, 2011, p. 2). The use of computers in this way was in line with direct instruction educational beliefs, but was also due to the limitations of computer technology and the software available (Fouts, 2000, p. 2).

In the 1970s, personal productivity devices were being developed for consumer use with the launch of such companies as Apple, Tandy and Commodore. In addition to this, associated hardware technologies were being developed, including laser printers, INTEL processors, mice and the floppy diskette (Harrington, 2009, p. 42). In 1973, Transmission Control Protocol and Internal Protocol (TCP/IP) was developed, and this technology paved the way for the transmission of emails. (White, 2008, p. 4).

Classrooms in the US were beginning to adopt computers because they were more affordable in that country and offered a variety of uses (Fouts, 2000, p. 2; Pollard & Pollard, 2004, p. 1; Roach, 2010, p. 18). Newhouse (2002, p. 3) argues that many schools were integrating computers into their classrooms based on a rationale

that society expected all students to have computer-literacy skills. In 1972, software (such as word processors) was released to the commercial and educational market, followed in 1978 by other productivity software for working with spreadsheets (Harrington, 2009, p. 42). These innovations in technology were now no longer limited to US classrooms; schools in the UK and in some parts of Europe also started to adopt the technology.

The microcomputer arrived in UK schools in the late 1970s, when each school was investing in one or two of these devices (McGarr, 2009, p. 1097). Showing considerable foresight about how this technology could be effectively utilised in schools, the UK pioneered summer in-service courses for teachers (mostly those from mathematical backgrounds). McGarr (2009, p. 1097) suggests that this training was prioritised by the UK's Education Department because the development of teachers' computer skills was seen as essential. The Institute of Educational Technology was formed with the purpose of working alongside school leaders to promote professional development in educational technology, as well as undertake research in teaching educational technology (Institute of Educational Technology, 2012).

Meanwhile, in Australia, Queensland schools used computers in their classrooms, but it was not until the next decade that any coordinated approach or strategic initiatives emerged (Baskin & Williams, 2006, p. 1). In the 1970s, differing schools of thought developed about how a computer could be used in education to benefit students. There were those who believed the computer was mainly for drill and practice, as had been the case in the 1960s. Others, however, believed that a computer could be used as a tool to enrich students' writing and calculating, while a third group believed that computers should be used as a tool in the field of computer science and that all students should learn to program (Fouts, 2000, p. 2; Petras, 2010, p. 40).

Impacts on education

Although some government departments around the world, developed changes to policy and a minority of teachers responded to these changes, there was limited research to identify any impact or outcomes. By the late 1970s, however, research projects had provided data with which conclusions could be made (Eng, 2005, p. 638; McGarr, 2009, p. 4). The focus of this early research was to evaluate the

effectiveness of computers in universities, where software was used specifically in relation to science or mathematics. The studies investigated the impact of learning with technology using pre-and post-testing methods, as well as control groups and exams. Margolin and Misch (1967 p. 99) noted that from a whole-school perspective, computers at that time predominantly influenced school practices such as budgeting, scheduling, teacher assignment, computer-assisted instruction, counselling, information storage and retrieval, simulation of innovation, school operations and research.

Teacher acceptance of, or resistance to, educational technology was a new area of research. Harrison (1977, p. 3) found that many teachers knew very little about computer use in their specialised field and did not have the time or the motivation to develop new skills. Teachers were, Harrison suggested, unsure of the relevance of computing in their own field, believing that computers belonged primarily in the area of computer science. Hooper (1969, p. 246) noted that resistance to technology existed because it was perceived to undermine a teacher's role and create new centres of power. There was perhaps little reason for teachers to change their pedagogical methods, given that the dominant learning theories at the time were behaviourist and instructivist, and based on principles of tasks, subtasks and information processing, which gave rise to computer-assisted instruction pedagogies (Holkner et al., 2008, p. 9; Kulik & Kulik, 1991, p. 75; Petras, 2010, p. 40).

The research findings in this era included the impact of computers on students' achievements, motivation and changes in teachers' practice. Hooper (2008, p. 234) stated that "educational technology never reached or began to reach any of the big goals and big ambitions set for it by the pioneers in the 1950s, 1960s and 1970s". Kulik and Kulik (1991, p. 88) at the University of Michigan performed a meta-analysis on several hundred studies in classes taught with and without computer-based instruction and found that computer-based instruction increased exam scores by 0.30 standard deviations and was more effective when used over shorter periods of time. Hence, it was believed to have a novelty effect, temporarily increasing students' motivation and engagement. Gagne (as cited in Cilesiz, 2010, p. 488) identified that computers altered the process and outcomes of teaching and learning, including classroom interactions. Cerutti, Brubaker and Littler (1969, pp. 87–89) observed in a small study the positive impacts that computer use had on the

motivation of students who were otherwise disengaged or were diagnosed with particular learning-support needs. While the school district in the US had felt that the computer would be most useful with mainstream students, Cerutti et al. (1969) found the best outcomes were achieved with underachievers or those who were disengaged.

2.1.3 The 1980s

ICTs in society and education

During the 1980s, the use of the personal computer rapidly expanded as more sophisticated technology was released every few months. By the end of the decade, Tim Berners-Lee had begun the initial development of the World Wide Web in order to share text, image and audio files (White, 2008, p. 2). The implications for society included new systems and new fields of employment, which were replacing obsolete occupations. Training was required to build employees' capacity to understand and develop skills in the technological field (Molnar, 1997, p. 6).

Computers suited the general population due to operating systems, such as Microsoft Disk Operating System (MS-DOS), developed by Bill Gates and Microsoft. This operating system allowed users who had less computing knowledge or experience to interact with their systems. Computers were available with a suite of operating, application and utility software that could produce and transmit text, image and audio files. A computer storage system evolved to include Compact Disc Read Only Memory (CD-ROM) discs and drives, which could distribute entire books within schools and other environments (Newhouse, 2002, p. 3). In the US, supercomputers were developed and used in government organisations to solve complex problems and process enormous amounts of numerical data. In the late 1980s, mobile phones were in their early stages of development with wealthy business owners adopting these devices to enhance their communication with both staff and clients (Theisens, Roberts & Istance, 2010, p. 88).

While all these changes were happening in society, parallel changes were occurring in some educational environments. Governments, which were worried about losing the technological innovation race, increased funding to purchase more computers to be used in schools. (Cuban, 1986, p. 6; Wenglinksy, 1998, p. 9). The ratio of computers to students was a key indicator of success, and in 1983, the US government, aimed for one computer for every 125 students (Wenglinksy, 1998, p.

9). However, in Warschauer's (2003) major empirical studies at the University of California, Irvine, over a 10-year period, he argued that technology projects "too often focus on providing hardware and software and pay insufficient attention to the human and social systems that must also change for technology to make a difference" (p. 6).

Computers in education were re-branded as *information technology*. It was not until sometime later that *communication* was added to this phrase to produce information and communication technology or ICT (Pelgrum & Law, 2003, p. 19). Computers were being used for word processing, simulations, tutoring systems, touch-typing and maths games, in addition to drill and practice systems. In the 1980s, Apple Inc. introduced the Apple IIe, which became popular in schools with the introduction of game-based learning pedagogies. Games such as *Oregon Trail* and *Odell Lake* became popular as scientific simulation games.

In the US, schools faced increasing pressure to adapt (Pelgrum & Law, 2003, p. 20). In 1983, the US federal government report called *A Nation at Risk* identified computer science as one of the five new basics required, along with English, mathematics, science and social studies. This included an elaboration that students required an understanding of devices, electronics and related technologies, rather than be limited to basic application use. As a result of this, funding increased in the area of professional development of teachers (Culp, Honey & Mandinach, 2003, p. 11). In Australia, several national bodies developed educational reforms in the 1980s; however, it was not until 1988 that the use of computers and information technology in schools became a high priority (Education Queensland, 2012).

Cohen (1987, p. 154) argued that for many years teachers had been resisting technology innovations because teachers operated in a decentralised and isolated environment, were in charge of their own classrooms and teaching methods, and had very little reason to change. McGarr (2009, p. 1094) found that despite policies and initiatives, changes within classrooms were minimal.

Impacts on education

In the 1980s, there was an increase in the number of research projects occurring worldwide, on the impact of educational technology; however, there were many differing opinions on the results. Some educators held the belief that computers

may replace teachers, much in the same way that this was occurring in some industrial occupations (Newhouse, 2002, p. 12). Cohen (1987, p. 154) argued that the success of technology depended on a teacher's resistance to adopt innovations. Many teachers preferred to continue with traditional modes of teaching or use computers for basic administrative duties (Cohen, 1987, pp. 83–85). Cohen (1987) stated that many barriers further prevented innovation and suggested that although there was some documented evidence of a temporary increase in student motivation to engage in learning, the biggest impact was felt by the organisations that developed and sold the equipment. Cuban (2001) argued that change would take decades because teachers needed to be convinced that students would learn more effectively with technology. Cuban (2001, p. 13) also claimed, in further research, that the majority of teachers in the US were not using technology widely in their own personal lives, and this was a barrier preventing widespread change in classroom practices.

Other researchers had different findings that contrasted with the previously stated research. Kulik's (1983, p. 19) research, for example, was one of the first meta-analysis studies and involved reviewing 51 projects that evaluated computer-based teaching across Years 6–12. The results of this project showed that computer-based teaching raised students' scores on final examinations by approximately 0.32 standard deviations. There was also evidence of an improvement in student attitudes towards learning and that learning time was reduced with computer-based instruction. The Apple Classroom of Tomorrow (ACOT) research identified that the success of integrating technology largely rested with teachers and their use of the technology (Petras, 2010, p. 42). Teachers' beliefs about learning and their preference towards various pedagogical approaches resulted in a combination of approaches (Dunn & Rakes, 2010, p. 58). Some educators, for example, adopted student-centred learning beliefs, such as those offered by Seymour Papert, who developed the LOGO programming system based on constructivist learning beliefs (Petras, 2010, p. 40).

Further complicating the research findings was the ongoing debate about the indicators or research criteria on which success was being evaluated. Early research focused on the ratio of computers to students or the number of machines connected to the internet, yet as Scheuemann (2009) suggested, this data did not provide a

measure of learning success (p. 8). Subsequently, a new field of research was established to focus on frameworks to evaluate the success of technology use.

2.1.4 The 1990s

ICTs in society and education

Technology development continued to be the catalyst for changes in all areas of society. Computers became more affordable and the numbers of computers used in society and in education increased dramatically. As access to these devices increased online learning models, multimedia delivery and self-paced learning were introduced. The term *ICT* was introduced early in this decade, when email technologies created global communication opportunities (Pelgrum & Law, 2003, p. 19). In the US, a National Education Summit of educational leaders, business representatives and community leaders stressed the importance of educational technology and how teachers could best be supported to implement these changes (Coley et al., 1997, p. 10).

In the 1990s, operating systems, including Microsoft Windows and open-source systems, advanced new opportunities for collaboration and peer review (Pelgrum & Law, 2003, p. 45). Open-source systems resulted in higher quality, increased flexibility and cost-effective software, especially for businesses; however, there was some doubt about the reliability of open-source systems applications in education, due to problems with maintenance and ease of use (White, 2008, p. 7).

From 1995 to 1999, the World Wide Web multiplied at a rate of 263%, boosting to approximately five million websites at the close of this decade, but still only offered the ability to access or store information in images and text (Theisens et al., 2010, p. 84). Schools and universities developed websites to disseminate information globally in the form of online manuals (White, 2008, p. 2), and software evolved to generic business-standard packages with the internet becoming increasingly dominant (Hurd, 2009, p. 141). In addition to this, Web 2.0 services emerged and mobile phones became indispensable and changed the way that people accessed information and communicated with each other. The impact of these innovations was still yet to be realised in classrooms.

The use of technology in the 1990s became increasingly student-centred. There was renewed vigour in the belief that teachers and schools were preparing students

for the digital age and a responsibility to ensure that students did not miss out on these opportunities. Teacher education in the use of ICTs was also a focus; however, the funding for this was proportionately much lower than the funding for infrastructure and hardware.

In Queensland in 1998–1999, funding was provided for increased infrastructure and the professional development of teachers (DETA, 1999, p. 2). The key components of the policy included integrating computers in all curriculum areas, reaching a ratio of computers to students of 1:7.5, equipping all classrooms with internet access and ensuring that all teachers had a minimum level of skills in the use of computers for learning (Education Queensland, 2011, p. 1).

In 1998, the Victorian Department of Education released the Learning Technologies in Victorian Schools 1998–2001 policy, which set a goal to achieve a ratio of 1:5 computers to students, as well as a Notebook for Teachers Program, which provided a laptop for 36,000 principals and teaching staff over a five-year period. The focus of this policy was infrastructure rather than the professional development of teachers or the use of ICTs in the classroom (Ng & Gunstone, 2003, p. 245).

Impacts on education

Many educational-technology research projects were taking place in the US and UK. Given that many variables exist in relation to the role of technology in the classroom, clear findings on the effectiveness of technology to improve student achievements had been difficult to determine. Analysis of the results was a complex issue with many differing methodologies being used. There were studies on effective teaching, specific software applications, hardware devices and online learning. This research created a complex web of empirical evidence (Webb & Cox, 2004, p. 7).

Policies identified that technology provided significant potential for students' learning to be improved. This assertion was overwhelmingly supported by more than 94% of educational leaders in Organisation for Economic Co-operation and Development (OECD) countries, who ranked "the use of technology in instruction" as the second most important issue in public education (OECD, 2010, p. 24). Studies have shown that schools have largely been successful in reaching infrastructure goals (Norton & Hathaway, 2011, p. 204), yet this has not necessarily equated to

successful outcomes in terms of students' achievements. Research has shown that ICT in education can increase motivation, understanding, collaboration, creativity and access to information (Jimoyiannisa & Komis, 2010, p. 3). This was not always occurring because curriculum and teaching practices were not transforming and technology was still being underutilised (Cuban, 2001, p. 826). Studies found that 80% of school use of computers in the US secondary schools in 2005 was for word processing (51%) and internet (29%) and that there was a chronic shortage of subject-dedicated software (Hurd, 2009, pp. 148–150).

Wenglinksy (1998) argued that technology was "unlikely to improve academic achievement or indeed any other educational outcome of students" (p. 10). His argument was based on three points:

- teachers being resistant to adopting innovations when there were problems and technical issues
- the opportunity cost of other learning innovations due to large amounts of funding being poured into technology
- his beliefs about theories of learning, where students learn through social interactions that cannot be replaced by a device (Wenglinsky, 1998, p. 10).

The focus of most of the research conducted in the US, UK, parts of Europe and Australia at this time was to recognise the positive and negative effects of using computers in classrooms and how best to promote effective learning (Eng, 2005, p. 7). US research had often been considered the front runner, but in the late 1990s, the UK government formed the British Educational and Communications Technology Association (BECTA), whose role was to advise schools on effective ICT use based on a solid foundation of research and evidence. BECTA launched two wide-scale impact studies – the ImpaCT and ImpaCT2 projects – which commenced in 1999. These studies involved more than 2,000 pupils of differing ages in 60 schools in both urban and rural areas of England. The study found that ICT use resulted in enhanced student performance in some curriculum areas; however, there were insignificant enhancements in other areas (Eng, 2005, pp. 643–644).

Analysis of why policy and associated funding did not always equate to successful outcomes resulted in analysis of the framework for measuring success. The issue was complex and it was argued that the indicators for success should

include analysis of the process of pedagogy, the uses of educational technology, the attitude of the teacher, professional development, self-efficacy, teachers' beliefs about learning and outcomes for students (OECD, 2010, p. 28; Norton, 2011, p. 204). In addition to researching teachers' beliefs about learning, teachers' attitudes and beliefs towards their own ability with ICT were investigated. Confidence, skill and ability, as well as an enthusiastic desire to be a life-long learner of technology, were factors in a teacher engaging and exploring the use of technology in classrooms. Factors such as teachers' personal use of technology in their home or personal lives appeared to contribute towards their use of technology in their classroom (Jimoyiannisa & Komis, 2010, p. 4; Maddux et al., 2011, p. 205).

In Kendall and Wickham's (1999) book, based on Foucault's methods, they discuss the belief that "it is easy to regard technologies as having a particular 'impact' on society which society cannot resist" (p. 78). However, Kendall and Wickham (1999, p. 78) also outline a different perspective in which technology and society are part of a continuously developing dynamic system with inputs from social, cultural and political assumptions and that they mutually condition each other. In other words, technology alone does not create the impact; rather, the characteristics of the school community plays a major role in deciding which technologies are used and this varies depending on each school's culture.

2.1.5 The 2000s

ICTs in society and education

Towards the later part of this decade, the use of mobile devices including laptops, tablets and smart phones became widely accepted, across the US, UK and in other developed countries, because they were affordable, efficient and compact. Many secondary schools were now offering 1:1 laptop programs and the numbers of computers, including both desktops and laptops, were increasing, with a ratio of 1 computer to 5 students the average in OECD countries. (Theisens et al., 2010, p. 79). For those that didn't have 1:1 laptop programs, they aimed to provide at least 1 computer for every 3 students (White, 2009, p. 6). By 2008, household access to computers, including laptops, was approximately 80% in OECD countries (Theisens et al., 2010, p. 78).

Online services for retail, education and entertainment increased dramatically to include 250 million services or websites by the end of this decade (Theisens et al., 2010, p. 82). Social networking became popular with services such as Facebook and Twitter becoming a common way for people to communicate and businesses to market and advertise their products and services. In 2005, Tim O'Reilly popularised the new terminology *Web 2.0* and the growth in these services encouraged entire new industries in online learning systems, virtual eLearning spaces, web conferencing and online collaborative spaces (White, 2008, pp. 4–6).

New learning theories such as *Connectivism* (Siemens, 2004) proposed a learning methodology for the digital age in which learners watch, listen, interact, give opinions, ask questions or share information, experiences and resources. New theories coupled with interactive whiteboards and online learning-management systems required the use of new pedagogies in the classroom.

Many schools were still focused on infrastructure and hardware, with only some focusing on curriculum reform and teacher development (Jimoyiannisa & Komis, 2010, p. 3):

> Cuban (2000) noted 'most policy makers, corporate executive, practitioners, and parents assume that wiring schools, buying hardware and software, and distributing the equipment throughout will lead to abundant classroom use by teachers and students and improved teaching and learning'...'we found that access to equipment and software seldom led to widespread teacher and student use' (p. 2).

There was concern that ICT reforms were based on assumptions and preferences rather than empirical evidence (Margaryan, Littlejone & Vojt, 2011, p. 439).

In the global context, educational reforms were widespread. The US developed a new National Educational Technology plan in 2004, which included seven major policy initiatives: leadership, innovative budgeting, teacher training, e-learning and virtual schools, broadband access and a move toward digital content and integrating data systems (US Department of Education, 2004, p. 14) In the UK in 2005, BECTA released a policy titled Harnessing Technology: Next Generation Learning, which set out a range of strategies including developing e-confident systems, leadership, personalised learning and technology infrastructure, along with a comprehensive

research program covering six core areas to provide evidence to support the strategy (BECTA, 2008, p. 3). In Europe, the rationale behind policy development in ICT was based on economic, social and educational reasons (Scheuemann, 2009, p. 16). ICT in education was viewed as a strategic objective to develop the capability and efficiency of European countries' workforces, thereby leading to future economic stability or growth.

In Australia in 2008, the Labor Government released the Digital Education Revolution policy (Department of Education, Employment and Workplace Relations, 2008). This AU$2.4 billion initiative was marketed as a program to improve educational outcomes, transform learning and teaching environments, and increase social and economic participation. However, the funding only allocated 1.4% of this budget towards professional development of teachers. The focus continued to be on infrastructure not up-skilling teachers.

In 2005, Education Queensland developed the Smart Classrooms policy, which outlined how teachers were required to integrate ICT into their planning, curriculum delivery and assessment to enhance learning opportunities and outcomes for students (Education Queensland, 2012). Regional technology managers were appointed to regions within Queensland to provide technical support to schools and this role evolved to also include eLearning support. In 2009, Education Queensland launched the Computers for Teachers project, which provided every permanent teacher in Queensland with a laptop. This followed similar programs in other states in Australia.

Impacts on education

There was now a large body of research into the impact and outcomes of technology in education. Measuring the impact of ICT in education was challenging due to the complex and multilayered aspects of using ICTs, and at times, the findings were not entirely what was expected (Erstad, 2009, p. 21; Starkey, 2010, p. 3). Hixon and Buckenmeyer (2009) argued, for example, that "technology has made little impact on the educational process" (p. 2). The *ICT Impact Report* (Balanskat, Blamire & Kefala, 2006), conducted in Europe, presented discussions and recommendations from 17 impact studies and surveys carried out at a national, European and international level. The key findings from this report (Balanskat, Blamire & Kefala, 2006, p. 4) showed that:

- ICT impacts positively on educational performance in primary schools, particularly in English, but less so in science and not in mathematics.
- In OECD countries there is a positive association between the quantity of ICT use and students' performance in *Programme for International Student Assessment* (PISA) mathematics tests.
- Interactive whiteboards had a positive impact on students' learning in mathematics and science.
- Broadband access in classrooms results in significant improvements in pupils' performance in national tests taken at age 16.

McGarr (2009, p. 1100) quoted findings from a large-scale evaluation commissioned by the European Union, which, in 1993, investigated the use of computers in secondary schools. The research reported high usage of standard software applications, including desktop publishing (Microsoft Publisher), word processing (Microsoft Word) and computer-aided design (CAD) in informatics-related subjects. The report also found there was little emphasis on programming. The standard arrangement for schools was to have a separate computer laboratory timetabled for specific groups. While this offered an organised approach, it did not help to promote the integration of the technology. It was also found that teachers of specialised ICT subjects were less likely to support initiatives that encouraged the use of ICT across the curriculum because they feared it might reduce the need for an ICT-specific subject within schools.

While the infrastructure and policies were being developed, there was reluctance on the part of many teachers to engage with educational technology in the classroom. Barriers commonly included not having enough computers or access to the facilities, the cost of software or other devices, teachers being unaware of the benefits, and a lack of both technical support and teacher confidence in using the technology (Ertmer & Ottenbreit-Leftwich, 2010, p. 7; Hurd, 2009, p. 146). However, the *innovators* and *early adopters* (Rogers, 2003) of technology were enthusiastic about the potential for computer use in classrooms. According to Hurd (2009):

> Studies found that teachers with a home computer organised 10 more hours of ICT in lessons than colleagues without. Teachers who valued highly the use of computers were more likely to use them for 19 more hours per year

> and teachers who strongly embraced active styles of learning used computers 16 hours more than those teachers who were sceptical. (p. 147)

Over a 20-year longitudinal study from 1985 to 2005 that examined the use of ICTs in both primary and high school education, there were mixed results of teachers' perceptions of the effectiveness of the educational contribution of ICT. The longitudinal analysis showed that "computers allowed the teacher time to help individual students", "computers improved general attitudes towards the subject" and "computers improved examination performance" and there was an upward trend of teachers' perceptions of the value of ICT (Hurd, 2009, p. 151). There were downward trends in the areas of "computers improved higher order thinking skills", "teachers' own enjoyment of computer-based lessons", "computers help develop decision making skills" and "teachers in 1985 agreed or strongly agreed that ICT made an educational contribution". (Hurd, 2009, p. 151).

In other research, evidence showed that teachers' attitudes and perceptions or beliefs about the value of technology in education stemmed from their personal educational experience, and showed that unless they were challenged during the pre-service training or in the early years of teaching, they would base their pedagogy on their individual beliefs (Jimoyiannis & Komis, 2007, p. 167; Roach, 2010, p. 29). Phelps, Graham and Watts (2011) noted that many countries, including Australia, have an ageing population of teachers who were trained in the pre-digital era (p. 3). Ertmer and Ottenbreit-Leftwich (2010) noted how persuasive experienced teachers could be towards novice teachers who may want to innovate within the classrooms (p. 11). In relation to teacher confidence, Hurd (2009) found that almost 62% of teachers still felt that they lacked the confidence to make use of computers in teaching (p. 153). Studies also showed that classroom use of ICT promotes student collaboration and motivation, but academic achievement rates remain low or unsubstantiated and teachers struggle with the new demands (MacDonald, 2008, p. 429; Pollard & Pollard, 2004, p. 150; Starkey, 2011, p. 20).

Pelgrum (2001) showed that the reasons for the less than impressive results could be explained by identifying the potential barriers that prevented teachers from implementing ICT practices and presented results based on a worldwide survey conducted in over 26 countries in elementary and lower secondary schools (p. 174). Pelgrum (2001) identified three main obstacles that were prevalent in preventing

effective ICT integration into curriculum: insufficient numbers of computers, a teacher's lack of knowledge and skills, and inadequate numbers of computers with access to internet services. If the professional development programs are not well design and implemented, then the investment made in technology infrastructure is not optimised.

Hattie's (2009, p. 220) meta-analyses calculated the average positive effect size of computer-assisted instruction as being 25%. Hattie identified that there were no differences across grades, ability levels, subjects or duration of computer use. He identified that computers assisted in engagement and positive attitudes. His research also revealed that the most effective use was in situations in which:

- there was a diversity of teaching strategies
- there was pre-training in the use of computers as a teaching and learning tool
- there were multiple opportunities for learning
- the student, not the teacher, was in control of the learning
- peer learning was optimised
- feedback was optimised.

However, standardised testing remains a priority within our schools and this focus decreases the likelihood of teachers being innovative with technology due to the overwhelming force of data analysis (Pearson & Naylor, 2006, p. 284). Other researchers noted that indicators used to measure the impact of ICTs in education were still based on policy developed in the 1980s (Scheuemann, 2009, p. 7), and as in the previous decade, a redevelopment of a research framework focusing more on practice rather than outcomes would shift the focus of the research from products to processes (Crook, Harrison, Farrington-Flint, Tomas & Underwood, 2010, p. 58).

2.1.6 Current

ICTs in society and education

The growth of technology in society continues to evolve, with mobile technologies and the development and use of tablet devices and smart phones permitting endless possibilities for the global sharing of information and communications. The *2010 Horizon Report* (Johnson, Smith, Smith & Stone, 2010, p. 3) identifies a number of emerging technologies to watch, including the abundance

of internet resources; anytime, anywhere work and learning; cloud-based technologies; collaborative technologies; mobile computing; open content; and electronic books. Unfortunately, technology growth has created the *digital divide* between developed and developing countries: in developing countries such as Africa, less than 10% of the population has computer access (Voogt, Knezek, Resta & Searson, 2011, p. 2).

Many of these emerging technologies are already in use in educational environments. The *Trends Shaping Education* report documents how information technology has developed rapidly over the past 40 years: processors have become faster, smaller and more powerful, while also becoming more affordable. As a result of this affordability, an increasing number of students have access to these mobile devices (Theisens et al., 2010, p. 80). This same report notes the uncertainty over the value gained from ICT for student learning and raises these questions: How can ICTs be more effectively integrated into the learning process? And given that ICT has the potential to allow more self-paced, interactive and personalised learning, how can its potential can be better exploited?

Some educators have seen the potential for learning in social networking spheres, given the increased ease with which students can communicate and collaborate within them (Maddux et al., 2011, p. 160). Digital media literacy has not yet been addressed in teacher-education programs adequately: the focus should be on how to use technology for complex, creative and critical thinking, rather than on the specific digital or Web 2.0 tools themselves (Johnson, Adams & Hayward, 2011, p. 7). In addition, it has been argued that knowledge creation and learning through connections are necessary for learning in the digital age (Starkey, 2011, p. 2) because the teaching of information is no longer the priority when information can be searched and acquired by simply using any number of devices currently available (Maddux et al., 2011, p. 18).

In the US, the Obama administration has implemented the National Education Technology Plan (NETP), which is a model of learning underpinned by technology, across learning, assessment, teaching, infrastructure and productivity (US Department of Education, 2010 p. 8). Teacher associations, such as the International Society for Technology Educators (ISTE), now document their approach to technology integration as a core component of higher-order thinking, problem

solving and authentic learning experiences (Maddux et al., 2011, p. 28). Some administrators recommend that at least 30% of funding should be set aside for professional development of teachers when any new ICT policy is being implemented (Voogt et al., 2011, p. 5).

In Queensland, the Smart Classrooms Strategy (Education Queensland, 2011, pp. 3–4) provides direction on working digitally, developing professionals, enabling learners and harnessing the enterprise platform. In relation to curriculum, ICT continues to be promoted as a skill essential to all learners. The Australian National Curriculum outlines ICT skills as a general capability, in the same vein as *literacy* and *numeracy*, while *technology* is recognised as a stand-alone subject, within the context of materials, systems, inputs and processes (ACARA, 2012, p. 18).

White (2008, p. 16) suggests that there is a need to have a deeper analysis of ICT uses, trends, impacts and effects on learning. He proposes renewed research into the way students learn best while surrounded by technology and how collaboration using ICT can enhance education. McGarr (2009, p. 1106) argues that any future initiatives regarding ICT in education should not be presented as ICT initiatives, but rather as initiatives in teaching and learning, which are relevant for all teachers.

Impacts on education

Credible research showing the positive impact that technology has on classroom learning is limited. According to Scheuemann and Pedro (2009), such research "has been difficult to achieve because of the lack of large-scale, longitudinal studies and a lack of methodologies that can capture the complexity of ICT and other elements influencing educational quality" (p. 14).

There have been many comparisons made between educational environments with differing uses of technology, as well as 60 meta-analyses of these research projects since 1980, but no single piece of research has answered the question of what the overall impact of technology use is on student achievement (Tamim et al., 2011, p. 5). Research is still needed to determine the most effective skills necessary to engage in learning, education and the development of knowledge in an ICT-connected world.

Teachers' confidence with using technology and their perception of the role of technology continues to impact on its use in the classroom. After more than two

decades of ICT use, there has been little change to pedagogical practice (Dunn & Rakes, 2010, p. 57; Jamieson-Proctor & Finger, 2010, p. 13). Schools and teachers clearly change at a slow pace (Sipila, 2012, p. 3) and changes in technology use will only occur once the benefits of using the technology become clear. Two main factors were found to have a significant impact on classroom use due to the effect on a teacher's readiness and willingness to bring ICT to students: providing teachers with laptop computers and technological and pedagogical support in relation to their use; and teachers' personal use of computers outside of classroom (Sipila, 2012, p. 13). Cilesiz (2010, p. 488) argues that a phenomenological approach to studying experiences with educational technology can advance the field by complimenting and unifying existing research, through focusing on the cultural and emotional impacts of technology on teachers.

2.1.7 Summary

Technology, and the rising expectations of society in relation to its use, will continue to impact on and will likely further transform our educational practices. As mobile technologies progressively permeate our everyday lives, it is clear that learning will become more personalised and eLearning will provide opportunities for connecting beyond traditional classroom structures. As these changes take place, it is also clear that continued research into how these technologies influence teachers' practice and students' learning will remain a central concern for those leading the professional development of teachers. Given these changes it is essential that teachers' knowledge and skills is developed through well designed programs of professional development. Poorly designed or implemented professional development can have little or no impact on teachers' practices. Literature on professional development, including what constitutes effective professional development, is reviewed in the next part of Chapter 2.

2.2 Topic 2: Professional development of teachers, specifically in the area of ICTs and technology

This section of the literature review examines professional development models, noting in particular the features of effective professional development. Further research on the impact that teachers' attitudes and perceptions have towards professional development is provided, as well as the barriers or challenges that may hinder effective outcomes for professional development.

2.2.1 Introduction

As outlined in Section 2.1.5 the 2000s, p. 20, less than 1.4% of the AU$2.4 billion Digital Education Revolution initiative has been allocated towards the professional development of staff in relation to the use of ICTs or digital pedagogies (McPhee, 2011, p. 13). Hattie (2009) states that it is the teacher that has the biggest effect on students' learning and that while "computers may increase the probability of learning, there is no necessary relation between having computers, using computers and learning outcomes" (p. 221). This is also supported by the *ICT Impact Report*, which notes:

> The impact of ICT is highly dependent on how it is used. The impact of a specific ICT application or device depends on the capacity of the teacher to exploit it efficiently for pedagogical purposes. (Balanskat et al., 2007, p. 5)

School leaders have to ensure that professional development opportunities exist for teachers to develop their pedagogical practice over many areas, including differentiation, literacy, higher-order thinking, in addition to technology and ICTs. Likewise, teachers must take ownership of their professional learning and ensure that they engage with necessary change to ensure that they provide the best learning experiences for their students.

Yoon, Duncan, Lee, Scarloss and Shapley (2007) found numerous studies that provide evidence of improved student outcomes if the teacher has undergone professional learning. According to the Australian Institute for Teaching and School Leadership (AITSL) (2011):

> there is compelling evidence that effective professional learning improves the capability, confidence and efficacy of teachers and school leaders, which

> in turn has a direct impact on the quality of students' educational experiences and the outcomes of the Australian school education. (p. 2)

2.2.2 Professional development models

Research suggests that the historical methods for providing teachers with professional development, while perhaps the easiest methods for delivering training in busy organisations, do not usually equate to positive change in classroom practice. Borko (2004) argues, "despite recognition of its importance, the professional development currently available to teachers is woefully inadequate" (p. 3). Common practices in schools, based on instructivist learning methodologies are usually carried out on isolated days at the start of the teaching year or when the teacher is released to attend workshops at an external location. The goal of this kind of professional development is usually to increase the skill and ability of an ICT tool or resource. Wells (2007) found that "this approach typically results in a failure to accomplish the long-term, durable impact on teaching practice" (p. 102). Ingvarson (2003) argues that the overall pattern of providing professional development is brief, fragmentary and rarely sequential. In an editorial collated by F. Michael Connelly, Ball and Cohen argue

> Although a good deal of money is spent of staff development in the United States, most is spent on sessions and workshops that are often intellectually superficial, disconnected from deep issues of curriculum and learning, fragmented and noncumulative. (Connelly, 2008, pp. 114–115)

The planning, implementation and subsequent evaluation of professional development models rest with educational leaders; however, encouraging teachers in the design and evaluation of professional development will ensure ongoing and sustained engagement. The importance of professional development cannot be understated, as evidenced in Hargreaves and Fullan (1992):

> a teaching force that is more skilled and flexible in its teaching strategies and more knowledgeable about its subject matter is a teaching force more able to improve the achievement of its pupils. (p. 2).

Webster-Wright (2009) found that there was a body of research literature on professional development within education; however, only 26% of the studies were suggesting the use of alternative professional development programs. This has led to

an increasing trend of research that focuses on alternative approaches, conditions and strategies (Gilbert, 2011; Petrie & McGee, 2012).

Mayer and Lloyd (2011) identify the difficulties that researchers encounter in measuring the impact of professional development in relation to student outcomes: professional development is a process that is conducted over time and involves several stages, including teacher learning, teacher change, student learning and student achievement, and little research has been conducted to take into account these multiple stages (p. 3). Guskey's (2005) five-level approach to evaluating professional development is an ideal framework to ensure that professional development programs reach their intended targets and objectives (p. 14). These levels link directly to the implementation of ICT and include:

- Participants' reactions: if teachers' attitudes and beliefs in ICT are pre-determined as negative, this negatively impacts on their engagement and motivation with the professional development.
- Participants' learning: the professional development must engage and inspire participants.
- Organisational support and change: the delivery of ICTs in the classroom must be backed by stable infrastructure and technical support.
- Participants' use of new knowledge and skills: teachers should be encouraged to innovate and implement the new skills in the classroom and reflect on their success.
- Student learning outcomes: benefits for students must be considered.

The purpose of professional development has not changed, but many things in regards to technology have changed, and subsequently, professional development in ICTs needs to adapt. Given that the majority of teachers today were training in teaching before ICT was a major development, there is a need to develop teachers in this area (Condie, Munro, Muir & Collins, 2005). Darling-Hammond and Richardson (2009) note that there must be an opportunity for observation and reflection of one's own practices over a sustained period of time. Professional development programs should have several stages, like any sound learning methodology in which the skills and knowledge acquired are then put into action. Darling-Hammond and Bransford (2005) recommend that teachers must be fully supported through this phase of enactment.

Yoon et al. (2007) found that any professional development program that lasted for fewer than 14 hours, showed no effect on student learning. However, when programs were longer than 14 hours and involved sustained teacher-learning opportunities, there were significant positive effects. The largest positive effects were for programs that offered between 30 and 100 hours spread out over 6 to 12 months.

Professional development models may take on many different forms and may vary depending on the human, physical and financial resources available within the school. This may include face-to-face workshops, online learning, informal learning opportunities and self-directed research. Mitchell, Stanelis and Travers (2010, p. 8) provide a comprehensive literature review on effective professional learning and an analysis of quality programs within Australia. Their findings include eight key recommendations for developing professional development programs in schools based on funding, collaboration, adequate access to technology, leadership, pre-service training and building partnerships to support teachers. Darling-Hammond and Richardson (2009) stress the importance of the leaders in any professional development process. The leaders must be supportive and must create a culture in which innovation and risk-taking is encouraged.

2.2.3 Features of effective professional development

A substantial number of research projects have identified the features of effective professional development (Garet et al., 2001; Gilbert, 2011; Guskey & Huberman, 1995; Guskey & Yoon, 2009; Lester, 2003; Mayer & Lloyd, 2011; McDonald, 2009; Petrie & McGee, 2012; Webster-Wright, 2009; Wells, 2007). Although some researchers focus on the outcomes of students as a key indicator of effectiveness, Timperley (2011) notes that the measurement of effectiveness includes a consideration of the engagement of teachers, as well as their changes in practice, because without this engagement, it is unlikely that this will result in any improved student outcomes.

Guskey and Huberman (1995) make it clear that there is no one model or set of features that suits every context and effective professional development must be adapted for a particular situation or environment. As schools are required to implement their own improvement agendas, the onus is on them to encourage

teachers to engage with these changes. While some may engage independently, some require persuasion to engage and some may resist any proposed changes.

The willingness to engage with professional development must be considered if there is to be a real and measurable positive impact in the way teachers change their practice. Brown Easton (2008) suggests that teacher attitude towards professional development may be more positive if it is referred to as professional learning. Brown Easton (2008) argues that "development evokes images of what someone does to someone else: develop them" (p. 775). In addition, Brown Easton (2008) recommends a series of professional learning opportunities that include goal setting, mentoring, analysis of data, planning and collaboration. Schuck, Aubusson and Buchanan (2008) highlight the importance of professional learning conversations, peer observation and collaborative reflection to contribute towards the professional development of teachers. Fullan (1995, p. 255) recognises that, at the core of any learning program, people need to have four core capacities: personal vision building, inquiry, mastery and collaboration. He also notes that "there is a ceiling effect on how much we learn if we keep to ourselves" (p. 257). The AITSL charter determined that professional development programs in ICT should have future-focused foundations incorporating globalisation, skill and confidence building to respond to emerging technologies and to support, encourage and promote innovation (AITSL, 2011, p. 3).

Darling-Hammond and Richardson (2009) stress the necessity of collaborative learning in a supportive environment where teachers are encouraged to take risks, evaluate and reflect. If teachers plan, deliver, assess, evaluate and reflect together, this may result in changes in their practice. Darling-Hammond and Richardson (2009) argue that the ideal environment in which this occurs is one where mentoring or coaching has taken place over a period of time and where there has been ongoing collaboration and support, and teachers have had time to reflect on their practice. Positive change can result from a mentoring approach based on modelling, observation and the opportunity for teachers to practice, reflect, take risks and modify their approach (Darling-Hammond & Richardson, 2009; Garet et al., 2001)

Table 2.1 summarises this large body of literature. Eight key pieces of research were selected and common elements of effective professional development were

identified. The five most common features across the breadth of research are that professional development should:

- be **contextual** and **relevant** and based around teaching and pedagogy
- allow for **collaboration**
- ensure that teachers are **engaged** in the process, including those who may initially be reluctant (volunteering is not considered as engagement because this excludes those teachers who may not engage willingly)
- be based on theory and **research** showing its positive impact and outcomes
- provide **follow-up and ongoing support** either from peers, leaders or external experts.

Table *2.1 Summary of research of features of effective professional development*

Author	Contextual or Relevant to teaching and pedagogy	Collaborative	Engaging teachers	Theory or Research based	Follow-up and Support	Evaluation of PD	Part of the bigger picture	Student driven	Length of PD
Wells (2007)	Contextual	Collaborative	Engagement	Theory or Research based	Support	Evaluation driven		Learner centred	Duration of process
Guskey & Huberman, (1995) p. 114	Integrate and have context	Teams/ collaboration			Follow-up, support		Part of a shared organisational vision. Think big, start small, set goals		
Gilbert (2011)	Active learning, inquiry and or linked to data and outcomes	Collaboration	Engagement of teachers	Theory or research based		Evaluation of the PD and reflection	Clear vision and shared understanding of purpose		Be a long term process
Guskey & Yoon (2009)	Focused on content and or pedagogy				Follow-up				30+ contact hours
Timperley et al., (2007) cited in Mayer and Lloyd (2011)	Context and linked to wider policies	Collaboration	Engaging teachers (regardless of whether they volunteer or not)	Time for extended opportunities to learn	Strong leadership involvement				
Hawly & Valli (1999) cited in Mayer and Lloyd, (2011) p. 4	Part of day to day work of teachers	Collaborative problem solving	Teacher ownership of PD design	Theory or research based	Continuous, ongoing, follow-up, support from external sources	Evaluation	Linked to comprehensive change process (part of the bigger picture)	Student learning or specifically targeting student outcomes	
AITSL (2011)		Collaborative						Relevant – driven by needs of students	
Jayaram, Moffit & Scott (2012)	Based on vision of effective teaching		Teachers empowered to own their development	PD must have demonstrated impact – link to theory or research					
Frequency – number of times features has been referenced in research	**7**	**6**	**5**	**5**	**5**	**3**	**3**	**3**	**3**

2.2.4 Teachers' attitudes and perceptions

When a technological change happens in a school, some teachers may become resistant to innovation and their beliefs about technology in education may be very different from the school's vision (Rogers, 2003). The literature suggests that teachers may believe that there is no valid reason to change their practice or they may be daunted by the rapid development of new technology and therefore lack the confidence to instil these practices in their classroom delivery. The issue of the confidence of teachers is discussed in several contexts in the following sections by exploring both their beliefs and the barriers or challenges that this creates. This discussion is significant because "if teachers' knowledge and beliefs are incompatible with reform goals, change will be limited" (Gilbert, 2011, p. 7). Engaging teachers in the process of change is therefore as much as issue of human resource management as it is an issue of technological or pedagogical change. Fullan (1995) states that "Professional development for teachers has a poor track record because it lacks a theoretical base and coherent focus" (p. 253). He adds that "if professional development is presented as an add-on to the day-to-day life of a teacher's work then it will fail to have any impact on their practice". In short, Fullan suggests that to have any real change, the professional learning must be integrated into the day-to-day operations of teachers.

An organisation's culture and the perception of the leader's personal beliefs contribute towards teachers' willingness to engage with any change process (Jamieson-Proctor & Finger, 2010). Therefore, to engage teachers in a process of change, leaders must reflect on the culture of the workplace and their own attitude or beliefs in this area.

Rogers' (2003) Diffusion of Innovations theory is a widely used and researched theory to help people understand the change-management process in a culture or an organisation. Rogers' theory is one of the most popular models and is the most appropriate for investigating the adoption of technology in educational environments (Sahin, 2006, p. 14). Sahin (2006) listed many researchers who have adopted Rogers' theory in the use of ICTs in educational environments. Rogers (2003) states that the innovation reaches critical mass through a series of stages in a social system. In this case, the social system is the school and the participants are the

teachers and their various levels of willingness or engagement to adopt ICT and technological change.

The theory identifies teachers as generally belonging to one of the following categories: Innovators, Early Adopters, Early Majority, Late Majority or Laggards.

- Innovators are teachers who are willing to experience new ideas that have a level of uncertainty. They may not be respected by others in the school.
- Early Adopters are teachers who lead innovations and inspire others through the interpersonal networks.
- The Early Majority take a little longer to decide to adopt new ideas, but they have important interactions with other members in the school.
- The Late Majority constitutes approximately one-third of all members of the school. They typically wait until the remainder of their peers have adopted the innovation. They are sceptical about any relative advantage it may offer. Peer pressure may lead them to adopt.
- Laggards have traditional views and the time taken to adopt is relatively long.

Rogers (2003) suggests that very little management is required to change the practice of the Innovators or Early Adopters because they are usually the leaders and are very willing to try innovations. The theory proposes that the majority of professional development opportunities should be directed towards the Early Majority group (approximately 34% of teachers) because they are enthusiastic; however, members of this group may face a number of challenges or barriers, which professional development can help them to overcome. Once these teachers are on board with the change, they will have an influence over the Late Majority group.

According to Hixon and Buckenmeyer (2009), any resistance to change can also be based on fear and/or personal values about teaching and learning. Hixon and Buckenmeyer (2009) state that some teachers believe computers "dehumanize the processes of teaching and learning" (p. 8). Teachers' personalities can also be linked to the rate of adoption of technology innovations, yet research in this area is lacking (Overbay, 2009, p. 4). Identifying the cause of resistance to change, whether it is fear, personal beliefs, personalities or otherwise can help leaders to better understand the motivation behind teachers' behaviours, and develop improved professional

development programs that will be better aligned with policy initiatives, which in turn will improve student outcomes.

2.2.5 Challenges or barriers towards effective implementation

Research has shown that there are a variety of challenges or barriers that prevent the outcomes for professional development from being reached (Ertmer & Ottenbreit-Leftwich, 2010; Schoepp, 2005). Bingimlas (2009) suggests a classification system for these barriers based on those encountered at the teacher level and those encountered at the school level. Teacher-level barriers include a lack of teacher confidence, a lack of teacher competence, resistance to change and negative attitudes. The school-level barriers include deficiencies in four areas: time, effective training, accessibility and technical support.

Schoepp (2005) identifies similar barriers through a meta-analysis study, in addition to deficiencies in equipment, software, teacher attitudes, funding, administrative support, fit with the curriculum, teacher incentive and scheduling. Wachira and Keengwe (2011) suggest that a range of internal and external factors are barriers to integrating technology, including teacher anxiety and deficiencies in these areas: the availability and reliability of technology, technology support and technology leadership, time, knowledge and confidence. Research on barriers specific to this study are outlined in the following section.

Strategic priorities

Schools are always subject to improvement agendas and reform, which, at present, includes the Australian Curriculum and improving the National Assessment Program - Literacy and Numeracy (NAPLAN) data. Professional development budgets are limited and have to cover training in literacy, reading comprehension, numeracy, leadership, pedagogy, behaviour management, vocational education and subject content, in addition to many other areas.

Given the difficulty associated with measuring the outcomes of ICT use, it is regarded as a lower strategic priority. Petras (2010) argues that "teachers are not using the technology because what is valued by school districts is high achievement test scores mandated by federal legislature" (p. 514). Because the school leaders rank ICT use as a lower priority, this sets the culture of the organisation and influences teachers' use of ICT. The school administration and leaders within a school influence

the innovative, creative or changing use of ICT (Drent & Meelissen, 2008; Fullan, 2002).

Ertmer & Ottenbreit-Leftwich (2010) discuss the importance of an organisation's culture and how much of an impact this collective culture has on an individual's ability to be innovative and creative. There can be an inherent *pressure to conform* in an organisation in which change is treated with cynicism in a social context. The role of the leader within the organisation must ensure that teachers are supported in their innovation and creativity, and must encourage risk taking so that new learning can be shared.

Lack of knowledge and the pace of change

Teachers have knowledge and skills in their content areas, as well as pedagogical knowledge and skill. Teachers also need to develop ICT knowledge and skill. However, due to the rapid rate of change with ICTs, many teachers are not even aware of some of the digital pedagogies that are available to them (Morris, 2010; Pelgrum, 2001). Research has shown that some teachers are hesitant and unsure of how to teach with technology because they have limited experience on either a personal level or at an educational level (Wachira & Keengwe, 2011). It was also found that while teachers had some skill in using administrative and communication tools, they were new to the concept of using technology for higher-order learning, critical thinking and problem solving (Voogt, 2011, p. 3).

Change resistance

Experienced teachers, who have formed opinions and beliefs about pedagogy and are knowledgeable about the content and skills in their subject area, may be reluctant to modify their practice in order to adopt new methods (Hixon & Buckenmeyer, 2009; Smith, 2005). Some teachers may be willing and eager to adopt change (Rogers, 2003), while others will be cautious or unconvinced about the benefit that these changes may bring. For some, particularly those who have limited technological skills, change may be threatening because it may expose knowledge or skill weaknesses.

To overcome this change resistance, Rogers (2003) notes that management should identify and focus on those Innovators and Early Adopters who will lead and champion the change and influence other teachers. However, in addition to this,

research has shown that management should listen to and engage with those teachers who are the most resistant to change (Fullan, 2002). Their viewpoints and opinions should be encouraged because this may then result in debate and discussion with the outcome being shared understandings, which may overcome some of the initial concerns (Fullan, 2002; Smith, 2005).

Lack of confidence

Some teachers lack confidence when faced with technical issues and they are not willing to try new software or emerging technologies (Drent & Meelissen, 2008). They may also have a fear of failure and anxiety about appearing unskilled in front of their students, thereby disrupting normal classroom routines (Ertmer & Ottenbreit-Leftwich, 2010; Morris, 2010). Ertmer & Ottenbreit-Leftwich (2010) argue that students with a high level of ability with technological tools might not have high levels of ability in how to use these tools for effective learning. This is where the teacher's pedagogical knowledge and ability can be enhanced through the use of ICT and technological tools.

Jamieson-Proctor and Finger (2010, p. 17) found that female teachers were less confident than male teachers in relation to using ICT in the classroom. They also found that approximately 70% of the teaching population was female and suggested that research into this area was needed to address the issue of confidence. Drent and Meelissen (2008) identified that teachers who were willing to experiment with different ICTs were more likely to have increased motivation. This willingness to experiment and have success in this area would further build confidence. Wachira and Keengwe (2011) found that:

> inadequate, unreliable technology and poor technical support only served to further discourage the teachers from using technology and heighten the anxiety for those who may want to use it. To attain confidence, teachers need time to learn, time to plan, time to collaborate with other teachers and time off to engage in professional development opportunities…teachers need time to be comfortable with technology in order to use or integrate it into their courses. (p. 23)

Time management

Time management for teachers is about prioritising tasks in order to meet not only personal goals but also school goals. Given that the vast majority of teacher

time is taken up planning, teaching, marking assessment, giving feedback and reporting, it is always difficult to find time for professional development, learn new skills, develop new curriculum and pedagogy with integrated technology (Cuban 2001; Gillard, Bailey & Nolan, 2008; Morris, 2010; Wachira & Keengwe, 2011).

2.3 Summary and implications

This chapter has argued that is important to examine research related to the change in barriers that teachers have faced in trying to integrate ICT into the classroom over the last 20 years. In Baek, Yung, and Kim's (2008) research, which looked at studies from 1988 to 2002, the main obstacles that prevented teachers from using technology were inadequate infrastructure, a lack of training and weak technical support. In reviewing research from the last 10 years, it was evident that the issue of infrastructure and technical support was being addressed through national and state policies and initiatives (Belland, 2009). Wachira and Keengwe (2011) found that while progress was being made in relation to the availability of technology, in some areas this was still inadequate, citing in particular some subject-specific software that was unavailable. Hixon and Buckenmeyer (2009) suggest that the biggest obstacle to furthering the use of ICTs in schools are "teachers' fundamental beliefs about the teaching and learning process" (p. 8)

Morris (2010) notes that there is a far greater body of research about the skills and acceptance of younger teachers with change and innovation compared with those who are more experienced and who were perhaps trained prior to the widespread use of ICT. This finding highlights the importance of this thesis, which focuses on how professional development impacts on experienced teachers' perceptions of their ICT practice.

In conclusion, it is clear from the literature that professional development in the ICT area needs to be firmly grounded in pedagogical and content areas, with less focus on technical skills. In addition to this, the leaders of the school need to build a culture of innovation, creativity, support (technical and pedagogical) and collegiality so that teachers' confidence, motivation and shared practices increase, which will ultimately have the desired effect of improving student outcomes. The adoption of a change theory, such as Diffusion of Innovations, (Rogers, 2003) using the social

system of teachers to influence other teachers to reach critical mass is founded in research and backed by empirical evidence.

Chapter 3 Research Design

This chapter describes the case study methodology employed in this research in order to find out how professional development impacts on experienced teachers' perceptions of their ICT practice. In particular, this chapter focuses on the research design that seeks to determine:

1. **What are experienced teachers' perceptions of their current ICT practices?** This includes a self-reported identification of how ICTs are used by teachers to implement effective teaching and learning environments, which incorporates communication, administration, planning, implementation and assessment practices.
2. **What impact has professional development had on experienced teachers' ICT practices?** This includes an analysis of the different types of professional development, the teachers' attitudes and perceptions towards the professional development and the impact the professional development had on experienced teachers' ICT practices.

The next sections discuss methodology, participants, instruments, procedure and analysis.

3.1 Methodology and research design

3.1.1 Methodology

This research centres on a case study within an Education Queensland state high school. Qualitative research, in particular, a case study approach, is a suitable method to determine changes in teachers' practice. Bassey (1999, p. 23) suggests that rigorous research must address the complexity of the various aspects of schools and take into account the different objective experiences and perspectives of teachers. Yin (2009) notes that a case study is a preferable methodology when considering the *how* and *why* issues related to contemporary events. A case study approach allows teachers to reflect on changes that have occurred in their classroom practices.

The selected school site represented a real-life context where teachers' ICT practices have changed over recent years. These changes have included

infrastructure, administration, communication and pedagogical practices, and involve many complexities, including changes of leadership, personal beliefs of teachers towards digital pedagogies and the movement and transfer of teachers. Yin (1993, p. 4) suggests that a case study is a form of empirical enquiry that allows for investigation of a contemporary phenomenon within a real-life context, as opposed to the context of an experiment or survey. The school where this study took place, a large metropolitan secondary school with over 140 teaching staff, provided a real-life context for the research and opportunities to gather appropriate data from multiple sources of evidence, including surveys and interviews.

To research changes in teachers' practice, it was necessary to identify *what* changes occurred, *why* they occurred and *how* they occurred. Kyburz-Graber (2004, p. 54) notes that case study research includes a comprehensive research strategy based on both quantitative and qualitative methods, and with a clear theoretical foundation. Further to this, Kyburz-Graber (2004, p. 54) suggests that a case study can be descriptive, explorative or explanatory. Explanatory case studies extend the findings to provide further in-depth analysis and theoretical explanations. Yin (2009, p. 9) maintains that different research methodologies are required in different educational settings. He suggests that if a researcher is asking a *how* or *why* question, and if the study does not require the control of behavioural events and is focusing on contemporary events, then a case study is a relevant methodology. This research project met all three criteria: it investigated *how* professional development impacts on experienced teachers' perceptions of their ICT practice; it did not try to influence teachers' practice; and the ICT practices under examination were contemporary events. It was therefore logical to conclude that case study methodology was the preferred model for the research that was undertaken at this site.

3.1.2 Research design

The research methodology outlined in this section was designed as a qualitative case study because the specific purpose of the research was to understand changes in experienced teachers' ICT practices at this site as a direct result of the implementation of ICT professional development methods. Johnson and Christensen (2008, p. 407) identify the case study design as that which details the particulars of the case, not only holistically, but also in order to understand inner workings, with the overall goal being to provide an evaluation of how effectively the program is

operating. Each school will vary in how professional development is implemented and the resulting changes in teachers' practice will be unique to that particular school.

In relation to a specific design plan, Yin (2009, p. 1) outlines a model for a linear, but iterative, process of research design that was used as a model for this case study (see Figure 3.1).

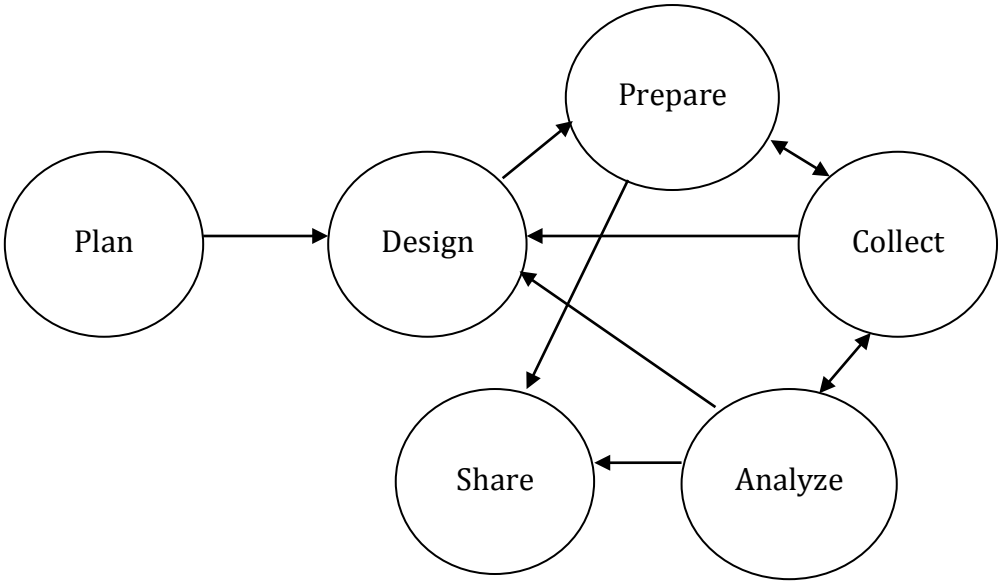


Figure 3.1 Design plan

This design plan has a cyclical nature. This suits a case study that attempts to gather evidence about people's attitudes, beliefs and practices because these can often change once an opportunity for reflection and evaluation begins.

Case study research, similar to all research, requires a theoretical perspective from which the case study will be approached. Becker et al. (2005) identify three of the most common adopted theories: individual theory, organisational theories and social theories. Individual theory was the most suitable for this case study because the focus of the research was directed towards an individual's development and behaviours in relation to the adoption of ICT practices and engagement with professional development. The first individual theory proposed was Rogers' (2003) Diffusion of Innovations Theory, which identifies varying degrees of engagement and adoption of new practices. The second individual theory proposed was Tearle's (2004) *A theoretical and instrumental framework for implementing change in ICT in education* Theory, which describes and analyses organisational aspects, such as corporate culture, work team values and team dynamics and how these relate to the

acceptance of innovations and a teacher's willingness to engage with professional development. Leaders' roles within the organisation and their impact on professional development implementation are also addressed. This has been reviewed in Chapter 2, Section 2.2.4 Teachers' attitudes and perceptions and will be analysed and discussed in Chapter 5 & 6.

Multiple sources of evidence were collected in order to provide valid, reliable and authentic data. Kyburz-Graber (2004, p. 59) identifies a series of quality criteria necessary for case study research and states specifically that numerous sources of evidence create multiple perspectives for interpretation and essential triangulation of the data. In this case study, teachers were surveyed and interviewed.

A chain of evidence is a key component of case study research design and is needed in order to provide valid, reliable and authentic information. Kyburz-Graber (2004, p. 61) notes that data selected must be linked to the original question and that evidence is drawn from the interpretations made from the data. In this particular case study, the sources of evidence were linked to the different components of the research questions. The sources of evidence include:

- the Australian Professional Standards for Teachers policy document, which set the benchmarks for what teachers' practices should be
- self-reported data created by or acquired from teachers through their participation in the interview and survey.

Table 3.1 identifies the sources of evidence that could be potentially linked to a specific component of the research questions.

Table *3.1 Sources of evidence*

Research questions	Source of evidence 1 – Policy	Source of evidence 2 – Teachers	Source of evidence 3 - Teachers
What are experienced teachers' perceptions of their current ICT practices?	Policy document – Professional standards for teachers	Survey with Teachers	Interviews with Teachers
What impact has professional development had on experienced teachers' ICT practices?	N/A	Survey with Teachers	Interviews with Teachers

These sources of evidence will be used to inform the Research questions and identify teachers, perceptions of their current ICT practices and the impact that professional development had on their ICT practices.

3.2 Participants

To determine teachers' current ICT practices, it was necessary to gather distinctive data-set using surveys and interviews that involved a selection of teachers who were willing to share their insight in an open and honest environment. Becker et al. (2005) recommend that the participant pool remain relatively small and also notes that the participants may be reflective of the diversity at the site, though this is not entirely necessary. The school has approximately 140 teachers of which 40 teachers formed a potential participant pool and were invited to participate. An online survey was designed that 16 teachers responded to, followed by one-hour interviews with six teachers, numbered 1 - 6 who met the following criteria:

- had at least 10 years of teaching experience in Queensland high schools
- attended a variety of professional development sessions on the use of ICTs in education
- had regular access to a class set of laptops or desktops.

Variety is defended as numerous and diverse sessions and regular access is defined as teachers being allocated a set of ICT devices available for their use. To ensure that the selected teachers participated effectively in the interview process, teachers were released from classes and interviews were conducted in a private room free from distractions.

3.3 Instruments

As stated in Section 3.1.2 Research Design, the instruments that were used as sources of evidence were policy documents and interviews and surveys that involved teachers.

3.3.1 Policy documents

AITSL (2011) published the policy titled *National Professional Standards for Teaching,* which "guides professional learning, practice and engagement and facilitates the improvement of teacher quality" (p. 1). In this research, this policy was analysed using a thematic analysis framework to identify those practices, which require the use of ICTs at a significant or frequent level.

3.3.2 Teachers

Survey

The sixteen experienced teachers, who met the eligibility criteria, completed a survey in relation to their ICT practices. This survey focused on teacher practices specifically mentioned in the National Professional Standards for Teachers policy (see Appendix A: Survey).

Interview

Six participants from the survey respondents volunteered to be interviewed about the impact that professional development had on their ICT practices. These six participants were coded participant 1 to 6. The interviews were designed to give the teachers the opportunity to reflect and to elicit responses on how and why their practices have changed. The interview included questions about how they work in a digital environment, how they engaged with professional development, how they enabled learners to utilise ICTs and the impact that changing infrastructure had on their ICT practices (see Appendix B: Interview). The survey and interview instruments were framed by the theoretical foundations of *Diffusions of Innovations* (Rogers, 2003) and *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004).

3.4 Procedure and timeline

The enquiry-based case study research used for this study involved a series of stages. As stated earlier, Yin's (2009, p. 1) model for a linear, but iterative, process of research design was used as a model for this case study (see *Figure* 3.1 Design plan).

The phases and timeline of the project are summarised in Table 3.2, followed by a more detailed explanation of each phase.

Table *3.2 Phases and timeline of project*

What	Details	When
Planning Phase	Identified research questions, completed literature review and chose methodology	November 2012
Design Phase	Refined case study design	December 2012
Preparation Phase	Foundation skills and knowledge required to conduct the case study (included training, establishing protocols and screening candidates)	March 2013
Collection Phase	Policy, teacher and administration evidence collected	November 2013
Analysis Phase	Processed and analysed data	June 2014
Sharing and Dissemination Phase	Prepared final document	December 2014

3.4.1 Planning phase

The plan for research was completed by November 2012. The planning stage included identifying the research questions, completing the literature review and identifying a suitable methodology. The research questions are:

1. **What are experienced teachers' perceptions of their current ICT practices?** This includes a self-reported identification of how ICTs are used by teachers to implement effective teaching and learning environments, which incorporates communication, administration, planning, implementation and assessment practices.
2. **What impact has professional development had on experienced teachers' ICT practices?** This includes an analysis of the different types

of professional development, the teachers' attitudes and perceptions towards the professional development and the impact the professional development had on experienced teachers' ICT practices.

3.4.2 Design phase

This case study design primarily focused on teachers' perceptions of their current ICT practices. This case study approach is referred to by Stake (1995, p. 38) as a case study that seeks to understand human experience and describe how things are, rather than why things are. To ensure that the research question was maintained as a focus, superfluous sources of evidence were dismissed in order to ascertain the most relevant evidence. Once these sources were clearly identified, the research questions became more logical and led to relevant conclusions. According to Yin (2009): "The design is the logical sequence that connects the empirical data to a study's initial research questions and ultimately to its conclusions" (p. 26).

3.4.3 Preparation phase

This essential element of the research design laid the foundation to ensure that the conclusions were relevant and valid. Yin (2009, p. 67) identified three essential components of the preparation phase. These are identified below with specific references to this case study:

1. Training: It was necessary to develop expertise in asking interview questions, putting bias aside to ensure genuine listening, being flexible in line with the cyclical research design and keeping aware of current issues that may impact on the case.
2. Establishing protocols: To ensure the highest standards of ethics were maintained and that the participants' privacy and confidentiality were upheld, knowledge about informed consent and maintaining confidentiality was acquired. From this knowledge, a set of protocols relevant to the case study was prepared.
3. Screening candidates: As stated earlier, the criteria list was created to select suitable candidates. This was considered along with the size of the participant pool. A screening process, consisting of relevant questions, was developed to ensure that candidates were suitable: suitability meant that

they were available during the collection phase, could reflect on their own practice and were willing to share their reflections. Criteria to assist in this screening phase included:

- had at least 10 years of teaching experience in Queensland high schools
- attended a variety of professional development sessions on the use of ICTs in education
- had regular access to a class set of laptops or desktops.

3.4.4 Collection phase

The data was collected in October and November 2013. Case study evidence is available from a variety of sources and in this section of the thesis it is argued that it is important to follow collection principles in order to ensure that quality data is collected and can be relied on and validated. The evidence collected for this research included documents and survey/interview responses. Consideration of the strengths and weaknesses of these data sources is addressed in the next two sections.

Policy

The strengths of this form of data are that the information is freely available from government websites. The purpose of using these documents is to identify the expectations that are in place in relation to teachers' ICT practices.

Personal evidence

Personal evidence is individual data acquired as a result of asking a question, conducting an interview or a survey and this was obtained from the teachers who formed the participant pool.

A variety of methods could have been used in this research to obtain data. Interviews with participants had the primary purpose of obtaining teachers' reflections about how they used ICT practices. Yin (2009, p. 107) suggested that interviews operate more like a conversation than a formal structured set of questions and answers. The role of the interviewer is to guide the conversation/interview by asking questions in an unbiased manner, focusing on behavioural events and the *how* questions. Stake (1995, p. 66) states that recording the exact words said during an interview is not necessary and that the interviewer should be able to recollect the responses. Given that the interview was considered a form of a verbal report, the

interviewer ensured that she listened closely while taking notes of key points and issues to later corroborate with data gained from other sources. However, to ensure that no key ideas or points were missed, the researcher recorded the interviews after obtaining ethical clearance.

3.4.5 Analysis phase

The process of analysis within the case study is outlined in section 3.5 Analysis. It is included here as part of Yin's (2009) framework for case study methodology.

3.4.6 Sharing/dissemination phase

The final document was completed by end of 2014 and a report on 'How professional development impacts on experienced teachers' perceptions of their ICT practice' would be of benefit to school leaders and leaders of professional development programs at either the federal, state, regional or school level.

Stake (1995, p. 123) outlines an organisational structure for the case study report. First, he suggests the use of a vignette to introduce and engage the reader with elements of the case. Following this, he suggests including:

- a section clearly identifying the issue, purpose and method of study
- extensive narrative that presents multiple perspective and opinions
- an account of the development of issues throughout the study
- descriptive detail, documents, quotes and triangulation of data
- assertions derived from the findings
- a closing vignette.

3.5 Analysis

To reach conclusions for the research questions, it is necessary to have a clearly outlined analytical strategy and accompanying techniques (Yin, 2009, p. 130). Given that case study research can produce a large quantity of data, there must be a clear process set and followed so that a systematic method results in answers that address the research questions (Mills, Durepos & Wiebe, 2010). The analysis method used in this case study is thematic analysis.

3.5.1 Survey analysis

For each question in the survey, respondents had to rank the response on a scale of 1 to 5. As a result, the data was numerical so it was imported into a spreadsheet to be arranged, averaged and sorted. Lists and graphs were produced to show the information in a visual from which along with the interview data helped to identify the themes relevant to the research questions.

3.5.2 Thematic analysis

According to Braun and Clarke (2006) "Thematic analysis is a method for identifying, analysing, and reporting patterns within data." (p. 6). Braun & Clarke notes that, unlike other analytical strategies, thematic analysis may not be connected to any pre-existing theoretical framework and its purpose is to report specifically on the experience of participants. Although thematic analysis has been widely used, within this and other analytical strategies, its process has not been widely documented (Mills et al., 2010). Thematic analysis focuses on the content, the patterns and the relationship between the patterns or themes. A theme is defined as "something important about the data in relation to the research question and represents some level of patterned response or meaning with the data set" (Braun & Clarke, 2006, p. 82). Chabi (2011) notes that thematic analysis is much more than a simple identification of themes: it is how these themes are structured and linked together. The analysis in this research project was focused on the link between experienced teachers' perceptions of their current ICT practices and the role that professional development played in this.

A large range of data collection methods and sources are suitable in a thematic analysis, including interviews and written documents (Reissman, 2008). Bernard and Ryan (2010) describe data as being indirect, direct or elicited, with policy documents categorised as *indirect* and interviews categorised as *elicited*. Interviews can be held in a variety of modes, including formal, informal or partly conversational, and the use of correct interview techniques and open-ended questions helped to elicit the necessary information required to complete the analysis. Open-ended questioning techniques encouraged enhanced reflection of the teachers' practice, which led to an increase in the data available for analysis. Closed questioning techniques were avoided because they usually elicit single-word responses.

The process of thematic analysis

The process suggested by Braun & Clarke (2006) involves a six-step method: preparing the data, coding the data, organising and identifying themes, defining themes, re-examining the text and finalising the themes. In order to analyse the data, the researcher needed to become thoroughly familiar with the scale and complexity of the content by conducting repeated readings of the data (Braun & Clarke, 2006).

Preparing the data

Given that the data came from a variety of sources, it needed to be prepared so that it was in a format ready for analysis, particularly in the case of the interviews. From the interview audio-recordings, it was necessary to transcribe the interviews into text and apply formatting techniques, such as wider margins to allow the recording of notes and line numbers, so that words, phrases or sentences were identified. Braun & Clarke (2006) notes that a transcription must be "true to its original nature" (p. 17), which means it should include nonverbal utterances (e.g. coughs) and accurate punctuation, so that the intended meaning is not altered in any way. These guidelines were followed in the transcription process.

Coding the data

Once the transcripts were prepared, coding commenced by reading the text and identifying major issues to obtain an overall picture of the topics. Following this, the text was re-read thoroughly, while making notes in the margin or highlighting text and phrases to identify various categories of information as well as adopting coding techniques. Coding is a brief description assigned to small quantities of data. Coding techniques assisted in this process and included word repetitions, key-words-in-context and sorting (Bernard & Ryan, 2010). Gibson (2009) suggests the use of a codebook or a code log, which records the created code, when you have applied it and how it is linked to other codes within the data. A codebook or code log was not used in this research, alternatively NVivo software was used to code, link and search data sets. However, it is important to note that the software program only assisted with the organisation of the data and had no capability to analyse or interpret the data.

Organising and identifying themes

Before the themes were identified, a list of potential themes was prepared as a guide. This process helped to clarify thought processes based on the research

questions. This list was purely speculative and referred to information extracted from the literature reviews and from the researchers own experience. One of the strengths of thematic analysis is that themes can be inductive rather than based on a framework, so this list served as precursor to final list. (See Table 3.3)

Table *3.3 Potential themes*

Research questions	**Potential themes identified to assist with organisation**
What are experienced teachers' perceptions of their current ICT practices?	Simplicity Strategic priority Personal attitudes and perceptions Relevance Educational beliefs Level of confidence Influences Technical support Change cycle
What impact has professional development had on experienced teachers' ICT practices?	Attendance at professional development Choices of professional development on offer Effectiveness of professional development on offer Timing of professional development Role of leaders Mentoring/collaboration opportunities

Once this list was created, thematic analysis techniques were applied. Thematic analysis allows for more flexibility in the research because the themes are identified based on patterns that are revealed during the data analysis. This approach is defined as "a process of coding the data *without* trying to fit it into a pre-existing coding frame, or the researcher's analytic preconceptions" (Braun & Clarke, 2006, p. 12). This process was followed, as there were two groups of themes, with each group relevant to one of the research questions. This allowed the identification of patterns or links between the groups of themes. Several linking themes were identified early with *change* being a common identifier in both groups. Linking themes were identified because of the appearance of terms and phrases that appeared across all data relating to both research questions.

Defining themes

A theme is defined as a linking together of the research participants' opinions, ideas, process, attitudes or experiences and can be related to a process, attitude or behaviour (Aronson, 1994). Once themes have been identified, researchers need to examine and explain the themes by naming and defining them, elaborating or providing additional explanations and offering examples that help to illustrate and

explain. Chabi (2011) suggests that themes are subject to classification and ranking, and this organisation helps the researcher to formulate holistic views on the relationships between themes across all of the data. These guidelines were followed by initially commencing with a list of themes that were significant in their regularity or significance within the data. The list was initially lengthy but by referencing the initial themes back to the research questions, patterns began to emerge as well as a theme that linked the two groups of themes together.

Re-examining the text

Further examples or illustrations from the data were identified that supported the clarification of the themes and links between themes. This was undertaken by examining the survey data and comparing to the interview data and find common elements throughout. The interview data was scanned three separate times with key words, terms and phrases highlighted from which a summary was prepared. After careful reorganisation and examination several patterns emerged.

Finalising themes

In order to finalise the themes, the researcher must delve deeply into the underlying meaning of each theme. Chabi (2011) extends the concepts of thematic analysis here to include identification of relationships between themes and visual representation, in the form of a concept map, to show themes and the links and paths between the themes. A visual diagram showing the five themes and how they linked together was developed and is presented in Chapter 6. This visual model clearly identifies links and relevance to the research questions.

Timeline

Table 3.4 shows the timeline of the project and the various phases of the case study analysis.

Table *3.4 Timeline of analysis*

When	What	Who
June - August 2013	Finalised data source methods, in particular Interview method	Researcher
October – November 2013	Conducted interviews	Researcher and participants

March 2014	Prepared the data for analysis, became familiar with data	Researcher
April 2014	Coded, used coding techniques and NVivo software	Researcher
April 2014	Organised and identified themes using techniques including sorting, developing word lists, key words in context	Researcher
June 2014	Defined themes	Researcher
July 2014	Re-examined the text carefully for relevant examples or illustrations to help establish links between themes	Researcher
July 2014	Finalised themes	Researcher

Strengths and Weaknesses

It was noted earlier that the strategy of thematic analysis has not been widely documented, which means there are advantages and disadvantages of this process. One of the strengths of this model is its flexibility: this allows the researcher to make inductive, creative and interpretative connections based on the data, which prevents descriptions of processes or experiences (Braun & Clarke, 2006). However, there are potential limitations, including the argument that breaking data into sections to fit pre-determined research questions can result in a fractured analysis, which may resemble a series of quotes or statements from the participants rather than a true analysis. Braun & Clarke (2006) notes further limitations when themes overlap or are insignificant, or when weak or inadequate numbers of examples are provided to support links between the themes. To overcome this, two themes were identified for each of the research questions. The final theme identified linked these groups together. The theme *change* overlapped both research questions, so this was divided into two themes so that further analysis could be made.

Considerations

Other factors that were considered, in the use of this strategy and have been outlined by previous users of this approach, including Braun & Clarke (2006) and Reissman (2008):

- themes must be coherent and must do more than describe
- themes must analyse and provide illustrated examples from the case study data.

3.6 Ethics

Ethical principles were followed to accurately determine the level of risk and potential benefits from the study. Appropriate permission letters were obtained, participant information and consents forms were accurate and adhered to and data collection tools, including the survey and interview, were designed and stored following ethics principles. All documentation was submitted according to QUT guidelines and approval from the University Human Research Ethics Committee was obtained.

3.7 Summary

The case study methodology based on survey and interview allowed for specific analysis against two theoretical frameworks. This process of thematic analysis resulted in themes relevant to the research question. Thematic analysis and case study methodology are suitable for contemporary issues occurring in educational contexts where there is an ongoing improvement agenda.

Before the analysis and the identification of themes are discussed in Chapter 5 & 6, results based on data from the survey and interviews are outlined in the next chapter.

Chapter 4 Results

Research has shown that measuring the impact of ICT use in education is difficult and, at times, the findings indicate that ICTs have had little impact (Erstad, 2009; Hixon & Buckenmeyer, 2009, p. 21; Scheuemann & Pedro, 2009; Starkey, 2010, p. 3; Tamim et al., 2011, p. 5). Researchers have also identified that after two decades of policies encouraging teachers to integrate technology into curriculum, there has been little change to pedagogical practice (Dunn & Rakes, 2010, p. 57; Jamieson-Proctor & Finger, 2010, p. 13) and that schools and teachers adopt change slowly (Sipila, 2012, p. 3). What this current research aims to show is where experienced teachers are currently utilising ICTs in their practice and how professional development is impacting on their practice. This is important given the significant investment made by both federal and state governments in relation to ICTs in schools (DEEWR, 2008; Education Queensland, 2009, 2011).

This chapter outlines the data from the survey and interviews, which aimed to answer the main research questions:

1. What are experienced teachers' perceptions of their current ICT practices?
2. What impact has professional development had on these practices?

Sixteen teachers completed the online survey and six teachers participated in the interviews. All results are shown in Appendix A and D.

4.1 Results overview

A map of the instruments and their relationship to the two research questions (see Figure 4.1) will guide the reader through this chapter and through Chapter 5.

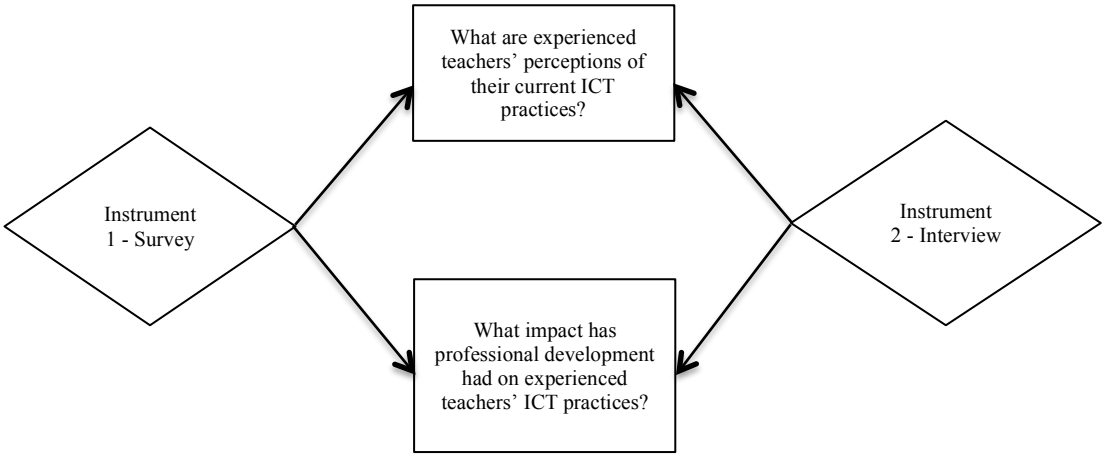


Figure 4.1 Map of instruments and research questions

4.1.1 Summary of survey method

The survey, completed online by 16 participants, included three parts:

- Part A was based on individual teaching practices and how ICT is used within these practices.
- Part B identified the types of professional development most frequently attended or accessed.
- Part C asked teachers about their attitudes and perceptions of the different methods of professional development.

For each question in the survey, respondents had to rank their response on a scale of 1 to 5. As a result, all the data was numerical, so it was imported into a spreadsheet to be arranged, averaged and sorted. Lists and graphs were produced to show the information in a visual form.

4.1.2 Summary of interview method

The interviews were digitally recorded using voice-recorder software and then transcribed into NVivo data-analysis software for classification and sorting. The word tally of the interviews was 33,000; the shortest interview was 3,693 words and the longest was 7,784 words. Three scans of the transcript, both horizontal and vertical, were undertaken to identify themes and patterns. The final summary of transcript was just over 6,000 words.

4.1.3 Summary of survey and interview results

The main findings:

- Teachers use ICT practices more outside the classroom than they do inside the classroom. This includes practices that may involve designing and creating curriculum, selecting resources, assessing students' work and reporting on students' outcomes.
- Teachers reported the belief that a moderate use of ICTs was crucial for teachers to perform their duties and responsibilities, but did not replace, and could not be a substitute for, other techniques, methods or strategies.
- Self-directed methods of professional development were more frequently accessed than other traditional methods. The most common were self-taught trial and error, personal use at home, and learning from family and friends.

- Self-directed methods of professional development had more impact than other forms of professional development. The most common methods were structured online courses, followed by self-taught trial and error, personal use at home, and learning from family and friends. Meetings, learning from a direct supervisor and social media had the least impact on teachers' ICT practices.
- Methods of professional development that were less frequently used included formal observation of other teachers and peer mentoring from school technicians.

The results are presented in the following sections, in line with the two research questions of:

1. What are experienced teachers' perceptions of their current ICT practices?
2. What impact has professional development had on experienced teachers' ICT practices?

4.2 Experienced teachers' perceptions of their current ICT practices

Results for this research question were obtained from both the survey and the interviews. Section 4.2.1 presents the survey results, and section 4.2.2 presents the interview results.

4.2.1 Survey results

Figure 4.2 illustrates the focus of this section, with highlights on the instrument used and the relevant research question.

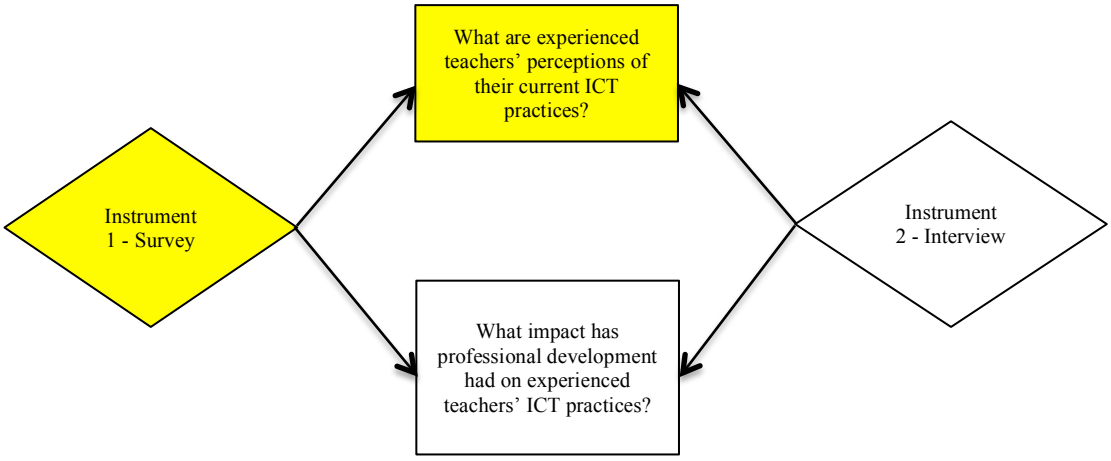


Figure 4.2 Map of survey and research question 1

The survey (shown in Table 4.1 and in Appendix A) required teachers to identify, on a scale of 1 to 5, how crucial ICTs were in helping them perform their role as a teacher. The scale options were 1: no ICT Use, 2: minor ICT use, 3: moderate ICT use, 4: major ICT use and 5: total ICT use.

The *National Professional Standards for Teaching* (AITSL, 2011) outline what teachers should know and be able to do and are grouped into three domains of teaching: professional knowledge, professional practice and professional engagement. Only the first five standards were used in this survey and this included a total of 27 *focus areas*, which are shown below.

Table *4.1 Survey based on 27 focus areas from National Professional Standards for Teaching*

Q1 On a scale of 1 to 5 identify how crucial ICTs are to help perform Standard 1 - Know students and how they learn.
1. I use ICTs to identify and understand the physical, social and intellectual development and characteristics of my students.
2. I use ICTs to understand how students learn including accessing research and collegial advice.
3. I use ICTs to design and implement effective teaching strategies for students from diverse linguistic, cultural, religious and socioeconomic backgrounds.
4. I use ICTs to design and implement effective teaching strategies for Aboriginal and Torres Strait Islander students.
5. I use ICTs to differentiate teaching to meet the specific learning needs of students across the full range of abilities.
6. I use ICTs to develop and implement strategies to support full participation of students with disability.
Q2 On a scale of 1 to 5 identify how crucial ICTs are to help perform Standard 2 – Know the content and how to teach it.
1. I use ICTs to develop knowledge of my content area and appropriate teaching strategies to develop engaging teaching activities.

2. I use ICTs to select and organise content into coherent, well-sequenced programs.
3. I use ICTs to design and implement learning and teaching programs based on curriculum documents (e.g. syllabus/work programs) and assessment and reporting requirements.
4. I use ICTs to increase my understanding and respect of Aboriginal and Torres Strait Island people to provide opportunities to promote reconciliation between Indigenous and non-Indigenous Australians.
5. I use ICTs to increase my knowledge and understanding of effective teaching strategies to support students' literacy and numeracy achievement.
6. I use ICTs to develop effective teaching strategies to integrate ICT into learning and teaching programs.
Q3 On a scale of 1 to 5 identify how crucial ICTs are to help perform Standard 3 – Plan for and implement effective teaching and learning
1. I use ICTs to establish explicit, challenging and achievable learning goals for all students.
2. I use ICTs to plan, structure and sequence learning programs that engage students and promote learning.
3. I use ICTs to select and use relevant teaching strategies to develop students' knowledge, skills, problem solving, and critical and creative thinking.
4. I use ICTs to select, create or use a range of resources that engage students in their learning.
5. I use ICTs to assist with effective classroom communication to support student understanding, participation, engagement and achievement.
6. I use ICTs to evaluate and improve teaching programs using evidence from student feedback and student assessment data.
7. I use ICTs to help engage parents/carers to be involved in their children's learning.
Q4 On a scale of 1 to 5 identify how crucial ICTs are to help perform Standard 4 – Create and maintain supportive and safe learning environments.
1. I use ICTs to support student participation by establishing and implementing positive and inclusive interactions to engage and support all students.
2. I use ICTs to manage classroom activities including establishing and maintaining orderly routines to create an environment where student time is spent on learning tasks.
3. I use ICTs to manage challenging behaviour, including establishing and negotiation clear expectations with students and address discipline issues promptly, fairly and respectfully.
4. I use ICTs to maintain student safety by implementing school, system, curriculum and legislative requirements.
5. I use ICTs safely, responsibly and ethically by using strategies that promote this to students.
Q5 On a scale of 1 to 5, identify how crucial ICTs are to help perform Standard 5 - Assess, provide feedback and report on student learning.
1. I use ICTs to develop, select and use informal and formal, diagnostic, formative and summative assessment strategies to assess student learning.
2. I use ICTs to provide timely, effective and appropriate feedback to students about their achievement relative to their learning goals.
3. I use ICTs to understand and participate in assessment moderation activities to support consistent and comparable judgements of student learning.
4. I use ICTs to review student assessment data to analyse and evaluate student understanding of subject/content, identifying interventions and modifying teaching practice.
5. I use ICTs to report clearly, accurately and respectfully to students and parents/carers about student achievement, making use of accurate and reliable records.

Full results from this survey are shown in Appendix C: Survey Data.

The results from this instrument showed that these experienced teachers' believed that only three focus areas required the use of ICT to a major level, 16 focus areas used ICT to a moderate level and only three focus areas used ICT to a minor level. None of the focus areas had results at the extremes of the scale (1: no ICT use or 5: total ICT use).

Overall, the standard that had the highest reported use of ICT was Standard 2: Know the content and how to teach it. Standard 2 includes content expertise, teaching strategies, sequencing of teaching programs and differentiation strategies. The standard with the next highest reported use was Standard 5: Assess, provide feedback and report on student learning. The data shows that the majority of ICT use by experienced teachers is occurring outside the class through planning and lesson preparation processes or through reporting processes. While schools have largely been successful in reaching infrastructure goals (Norton & Hathaway, 2011, p. 1011), there is ongoing concern about the use of ICTs to enhance students' creative and critical thinking and their connected learning (Horizon Report, 2011, p. 7; Starkey, 2011, p. 2). These results support this concern and it is suggested that the low level of ICT use by teachers in the classroom for higher order thinking and connections could be attributed to teachers' lack of knowledge (Morris, 2010; Pelgrum, 2001), limited experience with ICTs (Wachira & Keengwe, 2011), or in some cases, a lack of confidence (Ertmer & Ottenbreit-Leftwich, 2010; Morris, 2010). The next section presents the results from the interviews. Figure 4.3 shows the instrument used and the relevant research question.

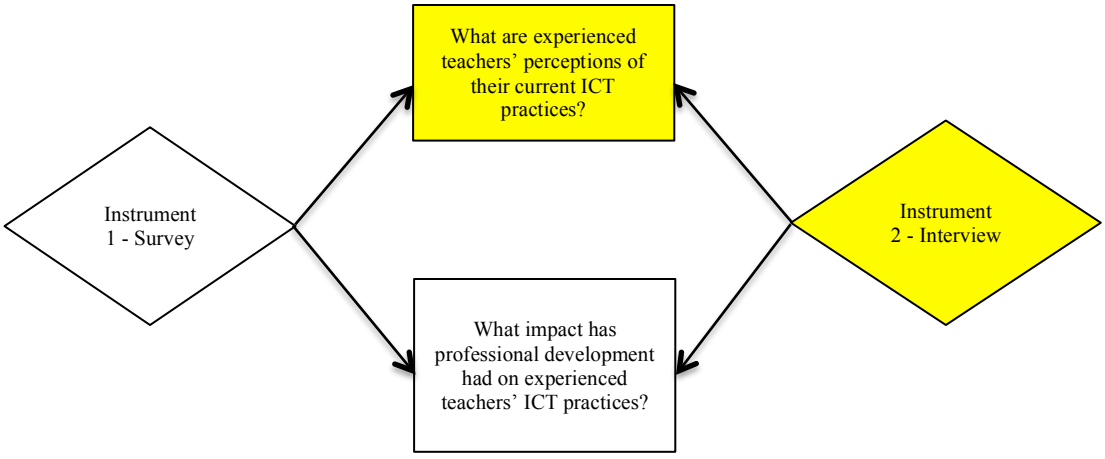


Figure 4.3 Map of interview and research question 1

4.2.2 Interview results

The interviews were conducted over a period of two weeks and generally lasted approximately one hour each. All interviews were digitally recorded and then fully transcribed. The goal of the interviews was to collect data on teachers' perceptions of their current ICT practices by asking them about the frequency of their ICT use, the primary use of ICT in areas such as administration, planning, implementation, assessment and communication, and if the rollout of higher numbers of laptops in the school had any impact on their ICT practices. The interview also sought to gather data on whole-school culture, school-wide processes and individuals' beliefs about ICT practices.

The interview data, once transcribed (see Appendix B for the full transcripts) and analysed, was similar to the survey data in that it showed that the majority of ICT use by teachers was occurring outside the classroom. The results indicate that all six participants were highly motivated and engaged in ICTs, and were keen to ensure that their use of ICTs benefitted students. All six identified a variety of access issues related to the use of ICTs, which prevented them from regularly utilising ICTs in their classroom. The primary use of ICTs was in the form of planning, email and finding resources. This corroborates the results from the survey. When ICTs were used internally, it was mainly for the dissemination of information, via the presentation of multimedia or textual information, or for inquiry or research. Importantly, no participant discussed the use of ICTs for critical or creative thinking. However, it was clear from the participants' responses that ICTs were frequently used to collect students' assessment, provide timely and detailed feedback, and maintain regular communication with students.

Teachers were asked about their perceptions of the whole-school ICT culture, the school-wide processes to maintain and improve ICT use within the school, and their own individual perspectives and beliefs about ICT use. These interview questions were based on the theoretical foundations of *Diffusions of Innovations* (Rogers, 2003) and *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004). The data shows that while the majority of participants felt that the whole-school culture and school-wide processes were encouraging ICT innovation and implementation, it was not as important as other school priorities, such as literacy and numeracy scores and Overall Position (OP)

results, which is the tertiary entrance rank process that Queensland schools follow. The lower priority on ICT use largely stems from the performance targets and standardised testing benchmarks that are at the forefront of all schools' achievements. In addition, it is not easy to measure the effectiveness of ICTs (Erstad, 2009, p. 21; Hixon & Buckenmeyer, 2009, p. 2; Starkey, 2010, p. 3); currently, ICT performance measures are based on staff and student opinions, and ratios of equipment to students.

The data from this research indicates that teachers believe ICT promotes student engagement and positive attitude (Hattie, 2009); collaboration; and the motivation of students, teachers and school leaders. However, demands from competing priorities and the pace of change cause obstacles (MacDonald, 2008, p. 429; Pollard & Pollard, 2004, p. 150; Starkey, 2001, p. 20). If leaders are lacking in their own knowledge and confidence in ICTs, and are managing other priorities in addition to shaping whole-school culture and developing school-wide processes, this results in further obstacles that prevent the effective implementation of ICTs. The role of school leadership in ICT practices is further analysed in Chapter 5. The next section presents the results for the second research question.

4.3 Impact of professional development on ICT practices

Results for this research question were obtained from both the survey (see Section 4.3.1) and the interviews (see Section 4.3.2).

4.3.1 Survey results

Figure 4.4 illustrates the focus of this section.

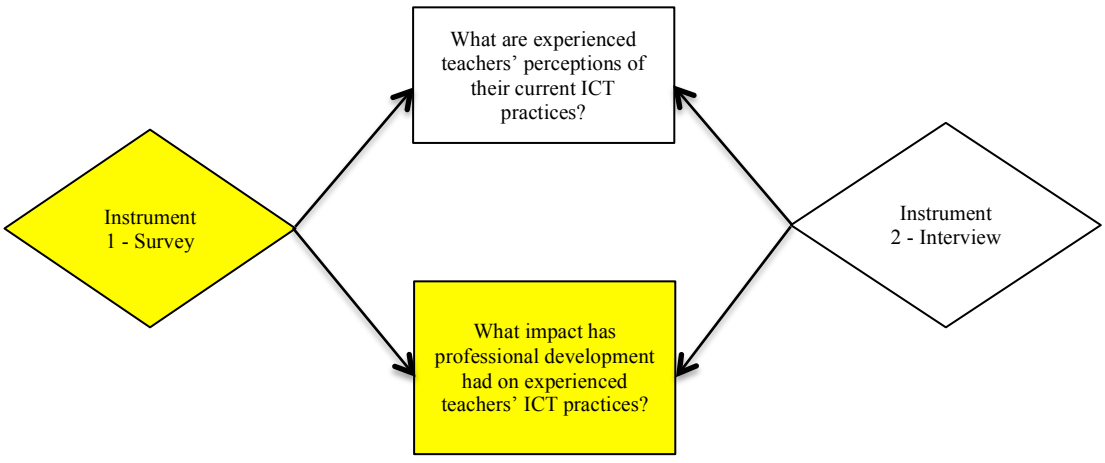


Figure 4.4 Map of survey and research question 2

In Part C of the survey, teachers were required to identify the frequency and types of professional development sessions attended or accessed, as well as the impact these sessions had on their ICT practices (see Question 6 and 7 of the survey in Appendix A). Teachers could choose from 23 different types of professional development and were given a scale from 1 to 5 to rate their frequency of attendance and the level of impact. Full results from the survey are provided in Appendix C.

Results were collected online and imported into a spreadsheet program. To enable a rank order to be presented, results from each participant were totalled and then an average result was calculated. This gave each type of professional development a score out of 5.00, rounded to two decimals.

Most frequently attended

Referring to Appendix C, Survey Data, Question 6, the five types of professional development that were most frequently attended were (starting from the highest frequency):

1. self-taught trial and error
2. personal use at home
3. learning from family and friends
4. peer mentoring from own colleague in faculty
5. learning from students.

The three most frequent types of professional development (self-taught trial and error; personal use at home; and learning from family and friends) are based on personal use or learning at home, which is supported by research showing that teachers' use of technology in their home or personal lives appeared to contribute towards their use of technology in their classroom (Jimoyiannisa & Kimos, 2010, p. 4; Maddux et al., 2011, p. 205). It is not surprising that these are the most frequent forms of professional development: first, they are flexible, and second, the majority of a teacher's time at school is taken up with planning, teaching, marking, giving feedback and reporting, so it is difficult to find time for professional development of ICT practices at work (Cuban, 2001; Gillard, Bailey & Nolan, 2008; Morris, 2010; Wachira & Keengwe 2011).

Least frequently attended

Referring to Appendix C, Survey Data, Question 6, the five least frequently attended or accessed professional development types were (starting from the lowest frequency):

1. structured online courses
2. formal observation of another colleagues' practice
3. social media
4. external course or workshop
5. conference.

Two reasons for the lack of frequency of some of these options are the financial outlay and the requirement for teachers to be away from their classes. However, if these options result in a positive impact, there is an opportunity here to increase attendance at, or access to, these forms of professional development. More analysis on the most frequently attended types of professional development is provided in Chapter 5.

Highest impact

To show the overall results for Question 7: Impact that professional development had on ICT practices, the results from each participant were totalled and then an average result was calculated. This gave each type of professional development a score out of 5.00, rounded to two decimals. The top five types of professional development that were found to have the highest impact were (starting from the highest impact):

1. structured online courses
2. external course or workshop
3. self-taught trial and error
4. personal use at home
5. learning from family or friends.

It is important to note that three of these types of professional development appeared in the top five for both the most frequently accessed and the highest impact.

Difference between frequency and impact identified underutilised types of PD

The results from the survey showed that the *structured online course* method of professional development had the highest impact, yet it was the least frequently used; this impact/use combination characterises it as an *underutilised* professional development method for the purposes of this study. School leaders must design professional development programs based on those methods that have the highest impact. This research has identified methods of professional development that have a high impact on changing teachers ICT practices, but for a variety of reasons, they are not methods that are regularly accessed or attended. If the impact of these methods is high, then it is logical to infer that an increase in the use of these methods should occur.

To identify such underutilised professional development methods, the following process and calculations were carried out on the data relevant to this section. The difference between frequency of attendance and impact of professional development was calculated. First, the results for **frequency of attendance** were sorted into ascending order and the results for **impact of professional development** were sorted into descending order. Then the result for impact of professional development was **deducted** from the result from frequency of attendance, with a negative number highlighting that the impact of professional development was higher than the frequency of attendance. These calculations resulted in a list of professional development methods that were not frequently attended, yet had a high impact when they were. Appendix E (Graph) and Appendix F (Table) show the full list of results.

It is acknowledged that there were only 16 participants in this survey; therefore, a limitation of these results is the small number of respondents. However, given this is related to one school site, future research and data collection on these methods of professional development could help to confirm or clarify these results. The top five methods from these calculations are analysed in the next section.

Underutilised types of professional development

The types of professional development that were characterised by low frequency of use and high impact were classified as underutilised. Figure 4.5 shows

the top five types of underutilised professional development (starting from the most underutilised):

1. structured online course
2. external course or workshop
3. formal observation of another colleague's practice
4. conference
5. peer mentoring from school technicians.

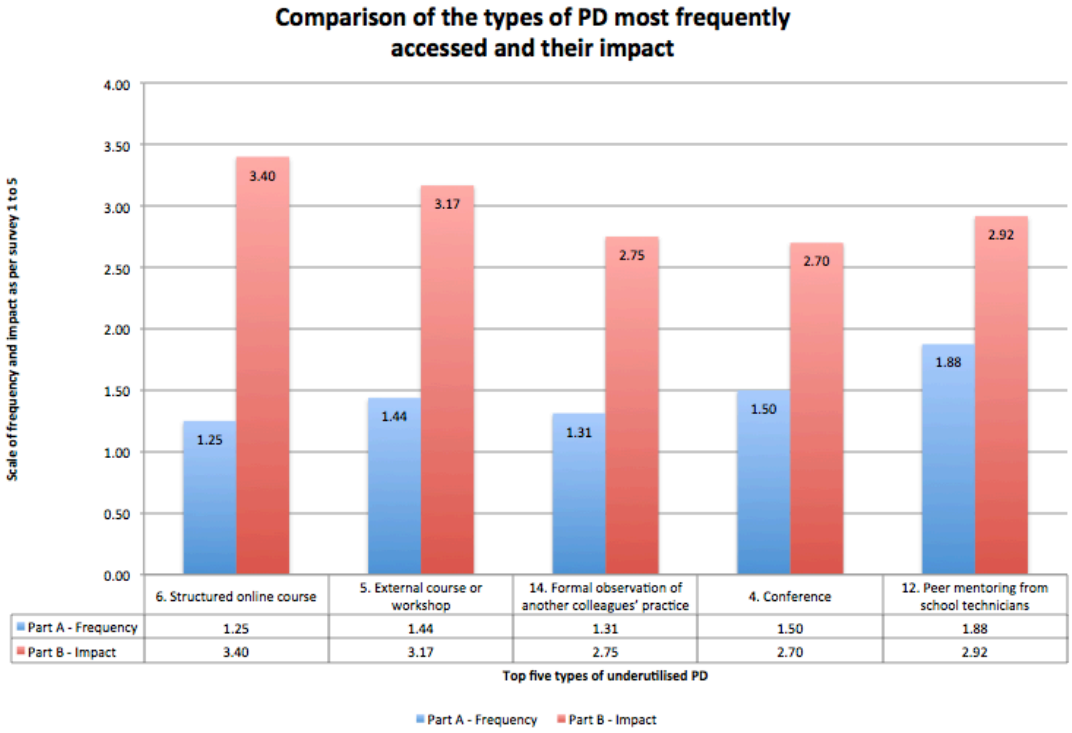


Figure 4.5 Underutilised types of professional development

If a type of professional development is classified as underutilised, this provides guidance to schools and teachers about where professional development resources can be channelled in the future. The implications of these results are further analysed in Chapter 5.

4.3.2 Interview results

Figure 4.6 shows the focus of this section.

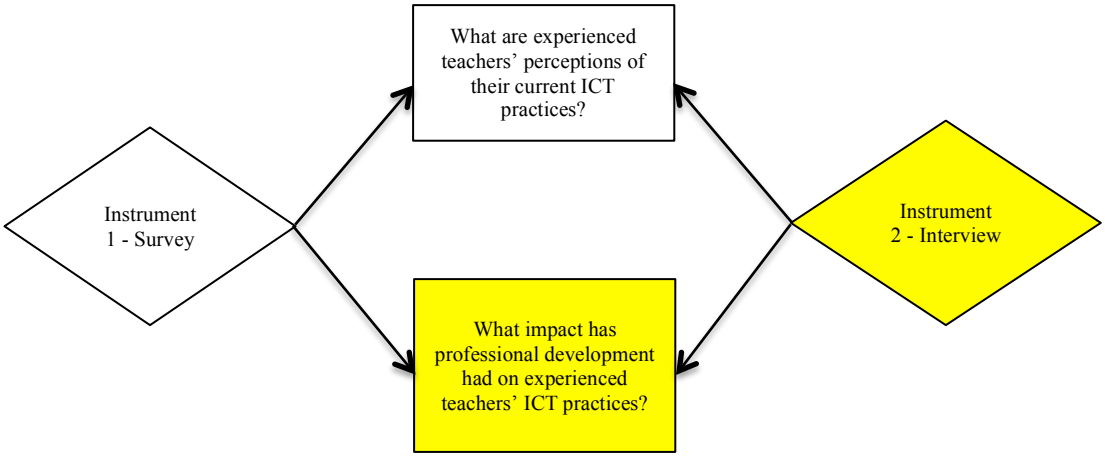


Figure 4.6 Map of interview and research question 2

The interview questions for this section are shown in Appendix B and focused on the impact that professional development had on ICT practices. Teachers were asked about their preferred types of professional development, which professional development had the biggest impact, which had the least impact, their attitudes and perception towards professional development, and what challenges and barriers they faced when implementing ICT practices learnt in professional development sessions. Key quotes from interviews are presented followed by interview results.

Key quotes from interviews

The following key quotes have been presented here to set the context. These quotes have been selected given their relevance to the research question and the significant detail offered by the participant. Full transcripts of the interviews are provided in Appendix D.

Participant 6 commented on the preferred type of professional development:

> Hands on sessions as I don't want to be lectured at. With ICTs in particular, I need to practice and have time to chunk it in my head. The fact that we had people presenting from within [the school] is excellent because you know there is someone you can go and talk to about it. The size of the group is important because there is always some sort of technology issue, so the smaller the better. I don't imagine you can do anything effective with a full hall of people.

Participant 5 commented on the professional development type that had the biggest impact:

> The professional development about the new data projectors, because I saw potential, but it hasn't had the impact on my teaching yet. But I like to think it is starting to. I think it will have a big impact. Also, some of the graphics calculators professional development. Some of the professional developments I've been to for that have been like 'wow', I want to do that in my classroom, and it's dependent on what I'm teaching in my classroom at that time. The 'wow' from the point of view [that] I could do so much for the students and the students could learn so much.

Participant 3 commented on the professional development that had the least impact:

> Every ICT professional development you attend you think: 'Yes, that's good. I'd like to do that.' And probably, for quite a lot of them, I haven't done much with [them]. This is mainly due to when can I fit that in, because I need time to develop the resources and time to use it in class.

Participant 2 commented on their attitudes and perceptions of ICT professional development:

> I think attending ICT professional development has given me more confidence to use a wider range of ICTs, rather than sticking with my favourites, because I know that the people around me are supportive, especially the kids. I will do a demo at home to see if it is going to work. But if I get in there and half way through it stops working, I know that the students aren't going to think 'she's useless', which is what I'll be thinking at that time, but they'll try something and it will usually work.

Participant 6 commented on the challenges and barriers they faced when implementing ICT practices:

> Time and technical issues. There is money, there is time, there is equipment and there are competing priorities and you have to get the balance of those things right. And when you do, it all falls into line.

The results from the interviews are summarised below according to two main themes: preferred professional development features and barriers to changes in ICT practices.

Features of preferred professional development methods

There was no clear preferred type of professional development mentioned by all participants; rather they described the *features* of professional development that they preferred. These features included being hands on, being done with small groups, the inclusion of practice time, the demonstration of practices, and the use of presenters from the teachers' own school. In relation to the impact that these professional development sessions had, the majority of responses were that professional development increases knowledge, motivation and confidence. In response to which professional development had the biggest impact, there was no clear pattern or trend within the responses. In response to which professional development had the least impact, the results were overwhelmingly that any professional development that lacked context had the least impact on changing ICT practice. The three main motivations for these teachers to continue to learn about ICTs were that they thought it would benefit their students, they had a personal interest in ICTs, and they thought it would improve their efficiency at work. These results are supported by Rogers' Diffusion of Innovations theory on the Attributes of Innovations (Rogers, 2003) and this connection is further analysed in Chapter 5.

Challenges or barriers preventing changes to ICT practices

The results for the challenges or barriers preventing changes to ICT practices included three main responses: conflicting priorities, inadequate follow-up or support after professional development, and technical issues. The data shows that the obstacles or challenges preventing the implementation of effective ICT practices have changed over the last few years. Lack of access to equipment or infrastructure was commonly cited as an obstacle (Ertmer & Ottenbreit-Leftwich, 2010, p. 7; Hurd, 2005, p. 155; Hurd, 2009, p. 146; Wachira & Keengwe, 2011). However, as technology evolves, so do the challenges and barriers; more research into these barriers is required so that solutions can be developed. Additional analysis on this topic is provided in Chapter 5.

4.4 Summary

As stated in Section 2.1, research has shown that measuring the impact of ICT use in education is difficult, and at times, ICTs appear to have had little impact. However, schools and teachers are expected to constantly adapt to new ICTs and the inclusion of professional development continues as school leaders aim to improve

teachers' capabilities. What these results show is where experienced teachers are currently positioned in relation to their ICT practices, and it is clear that experienced teachers primarily use ICTs outside the classroom. These results also show the methods and features of professional development that should be promoted and encouraged, as well as the ideal school culture in relation to ICT that will maximise opportunities to improve experienced teachers' use of ICTs to benefit student outcomes.

This chapter has described and summarised the data obtained from the research, and Chapter 5 uses a similar format to analyse these results. Results from both instruments relating to the research questions will be analysed and, in addition, the application of thematic analysis techniques, resulting in the identification of five themes, will be presented.

Chapter 5 Analysis

This chapter analyses the results and identifies and unpacks the major themes in relation to the research questions. The analysis was completed using a case study approach. This was a suitable method to determine changes in teachers' practice, particularly when reflecting on the *how* and *why* issues in relation to contemporary events (Yin, 2009). The purpose of the research was to determine current teachers' practices using ICTs and to determine the impact that professional development has had on these practices. The approach adopted for this case study was primarily about discovering an individual's development and behaviour in relation to the adoption of the ICT practices (Becker et al., 2005). The specific individual theory used as a conceptual framework of analysis was Rogers' (2003) Diffusion of Innovations theory on Attributes of Innovations, which identifies varying degrees of engagement and the motivation behind the adoption of new practices. The thematic analysis approach was adopted to identify, analyse and report patterns within the data (Braun & Clarke, 2006). This analysis method was chosen because it identified and explained the link between experienced teachers' perceptions of their current ICT practices and what the Diffusion of Innovations theory reveals about the professional development process. The thematic analysis methods focus specifically on the experience of the participants and the patterns and the relationship between the themes and how they are structured or linked together (Chabi, 2011). This analysis is framed by the theoretical foundations of *Diffusions of Innovations* (Rogers, 2003) and *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004).

5.1 Analysis process

The process followed to analyse the data was based on a six-step method, as identified in thematic analysis processes and case study research (Braun & Clarke, 2006): preparing the data, coding the data, organising and identifying themes, defining themes, re-examining the text and finalising the themes. Each step is outlined in the following sections.

5.1.1 Preparing the data

The data was prepared by putting it into a suitable format ready for analysis: the interviews were transcribed into NVivo software and the survey data was arranged

into a spreadsheet. The interviews were transcribed in full and were true to their original nature (Braun & Clarke, 2006) to avoid altering the intended meaning. Because the transcripts were very long, each one was scanned separately three times to streamline the data and help identify the themes.

5.1.2 Coding the data

The second step was to go through a process of coding the data using NVivo software. The query functions in NVivo helped to identify the significance and frequency with which teachers mentioned particular ICT practices or features related to professional development. An example of an NVivo query search is shown in Appendix G. In this example, the query was for Question 5 in the interviews: Identify the primary use of ICTs that you used in your teaching practice in the following areas: Communication with parents, students and colleagues both in and out of school. The responses included 24 references to email, 11 to learning, 8 to parents and 8 to students. Using a minimum word length of eight letters and with the exact/similar scale set to *similar*, the 10 most frequently used words were Content, Knowledge, Activities, Communication, Process, Working, Information, Thought, Change and Getting. The minimum word length of eight letters was chosen so that pronouns, action verbs, linking verbs and conjunctions were omitted from the coding. The scale of *similar* was used so that like words would be grouped together.

Using a system of manual coding, the text was scanned at least three times, both vertically and horizontally, to obtain an overall picture of the topics within the information. Significant text was highlighted in red (see Appendix H: Manual coding of text).

5.1.3 Organising the identifying themes

The third step was to organise and identify the themes, which became apparent after completing multiple scans of the text. These themes were topics that were mentioned a significant number of times throughout the interviews and that were given a high level of importance by the participants. The thematic analysis technique allows for flexibility in the research design because the themes are identified based on patterns rather than trying to fit them into a pre-existing coding frame (Braun & Clarke, 2006). Using this technique, five themes were identified: two themes belonged

to research question 1, two belonged to research question 2, and the fifth linked the other themes together.

As a first step to organising the themes, a list was prepared of terms that were frequently mentioned and were identified as important by the participants; the terms were then grouped according to the two research questions (see Table 5.1). Terms were placed into Column 1 when they related to the use of ICT or a pedagogical process. Terms were placed into Column 2 when they related to a feature of professional development. Some terms were related to both research questions, which resulted in the theme that linked the two groups together. Section 5.1.4 analyses how the terms align with the identified themes.

Table *5.1 Identification of themes*

1. What are experienced teachers' perceptions of their current ICT practices?	**2. What impact has professional development had on experienced teachers' ICT practices?**
Learning place	Hands-on
Data projectors	Internal
Email	Practice
OneSchool	Contextual
OneNote	Changing
PowerPoint	Outcomes
iPad	Self-paced
Changing	Follow-up
Planning	Priorities
Facebook	Time
Engagement	
Reinforce	
Students	
Leadership	
School culture	
Technical issues	
Priorities	
Time	

5.1.4 Defining the themes

The list of terms was matched to the research questions, and after multiple refinements, the terms continued to evolve and themes emerged. The process to make these decisions is outlined below.

ICT practices themes

Terms that related to specific hardware and software were eliminated (e.g. iPad), so that the themes were not so specific that they would become less useful as technology evolves. Terms that described ICT practices were grouped in relation to their use outside the classroom or inside the classroom. Most of the terms used to describe ICT practices that occur outside the classroom, which led to the first theme, *Primary use of ICTs outside the classroom*. Participants frequently stressed the constant cycle of change related to the ICT practices and the pressure placed on teachers by society to adapt and refine their pedagogy. The significance and importance given to this concept by the participants led to the second theme, *Changing and evolving use of ICTs*.

Impact of professional development themes

The theme of change also extended to the second research question in relation to professional development. The results showed that new ways of learning were having the highest impact on teachers' ICT practices, which led to the third theme, *Changing and evolving professional development of ICTs*. The impact that these new methods of professional development were having on teachers' practices and the identification of underutilised methods of professional development methods led to the fourth theme, *Promote the value of these alternative methods of professional development*.

Establishing the links between the themes

The final theme of *Upward management and skilling of school leaders* became evident due to the significance of all stakeholders in the process, including students and teachers, and the impact that users of ICT can have on the leaders in an organisation. This theme was pivotal in that it linked together the two research questions, referenced Diffusion of Innovations theory, involved whole-school ICT culture and provided a framework to further contribute to the professional development of teachers to improve their use of ICT practices.

Relationship to Conceptual Framework

To provide validity to the themes and their links, the conceptual frameworks, on which this study is based, namely Roger's *Diffusions of Innovations* (Rogers, 2003) and Tearle's *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004), will be used as the theoretical foundation for analysis and discussion of this research.

5.1.5 Re-examining the text

A third and final scan of the interview data and re-examination of the survey data was carried out with these themes in mind. This was to ensure that no frequent or significant terms or potential themes were overlooked. Relevant results were identified, additional data that supported or negated the initial themes were identified, and then the themes were adjusted (Whitelock, 2010). For example, the data on the two methods of professional development that had the least impact were related to the school's leadership team and the impact that school leaders have in shaping whole-school ICT culture. This relationship between engagement of school leaders and the impact they have on the professional development confirmed the importance of the linking theme *Upward management and skilling of school leaders*.

5.1.6 Finalising the themes

It is recommended that the final themes be identified in a concept map (Chabi, 2011), which allows for relationships between the themes to become evident (see Figure 5.1). These themes are interconnected, (Refer Section 5.1.4) and also cyclical, given the evolving nature of ICTs, learning through professional development opportunities and schools' ongoing improvement agendas. Another benefit in using this technique is that it allows further developments to be identified.

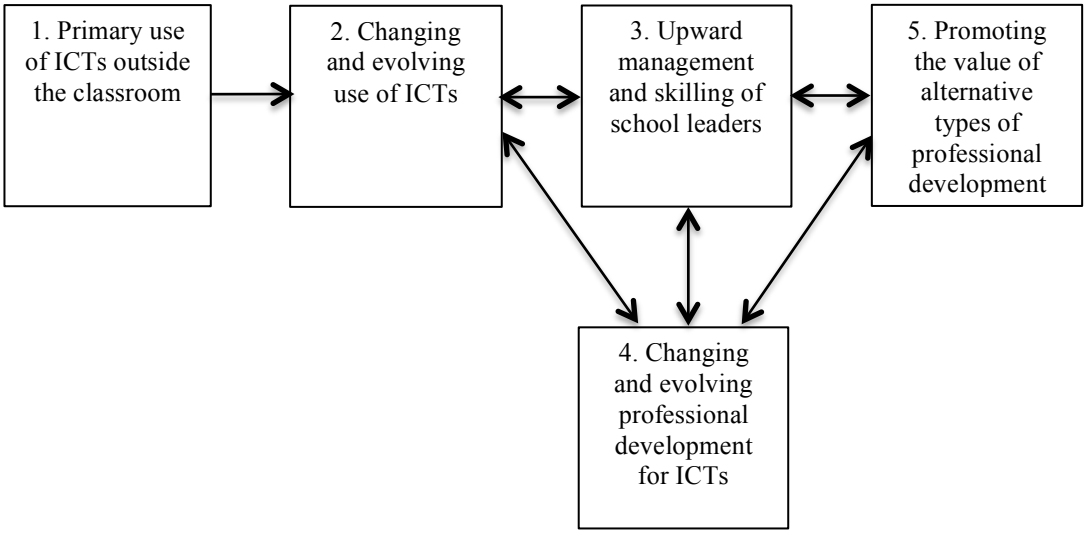


Figure 5.1 The final themes

5.2 Limitations of the thematic analysis process

The thematic analysis process used has both strengths and limitations. Its strength relates predominantly to its flexibility, but limitations in the process can result in the potential for fractured analysis. The limitations that occurred during this process included the length of the interviews and the learning curve in using the qualitative research software. Some of the interview questions were repetitive, e.g. Part B Q 21 and Q 22 and Part C Question 7, which created some duplication of data. The length of time taken to transcribe, scan and code the interviews into data and themes was also a factor.

5.3 Analysis overview

The purpose of this section is to analyse the results from Chapter 4 in order to answer the research questions of "How professional development impacts on experienced teachers' perceptions of their ICT practice".

This analysis aims to answer:

1. What are experienced teachers' perceptions of their current ICT practices?
2. What impact has professional development had on experienced teachers' ICT practices?

The reader will be guided through this process using a graphic organiser (Figure 5.2).

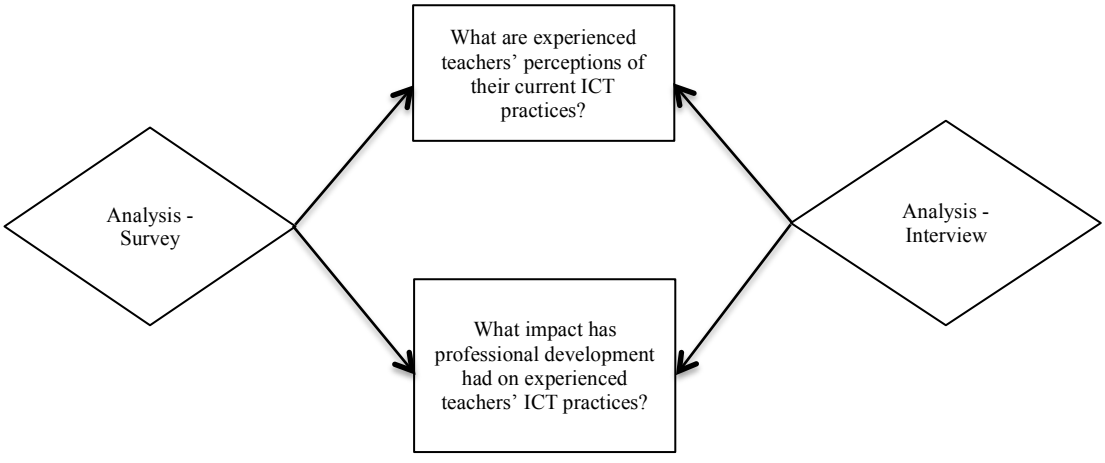


Figure 5.2 Map of analysis and research questions

First, the results from the survey and the interview are analysed to show experienced teachers' perceptions of their current ICT practices. The analysis also

discusses ICTs in relation to whole-school contexts and individual teachers' perspectives.

Second, an analysis of the most frequently attended professional development methods is discussed, identifying the impact these professional developments had on practice and which methods of professional development are currently underutilised in this school. The analysis also considers a teacher's attitude or perception towards professional development and the challenges or barriers that prevent the successful implementation of effective ICT practices. To provide a theoretical foundation to this analysis reference to the two conceptual frameworks will be included, namely *Diffusions of Innovations* (Rogers, 2003) and *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004).

5.4 Analysis of experienced teachers' perceptions of their current ICT practices

This section analyses the results from both the survey and the interview, and focuses specifically on the first research question: What are experienced teachers' perceptions of their current ICT practices? It was necessary to gain an accurate analysis of how experienced teachers were using ICTs in the classroom. The focus here was on teachers' self-identification of how they were using ICTs. This process of self-reported use leads to a more detailed analysis because many uses of ICT occur outside the classroom and the individual teacher would only know of this use. The next section analyses the results from the survey, which is followed by a section that analyses results from the interview.

5.4.1 Experienced teachers' perceptions of their current ICT practices: survey analysis

Figure 5.3 shows the focus on this section: the analysis of the survey results about experienced teachers' perceptions of their current ICT practices.

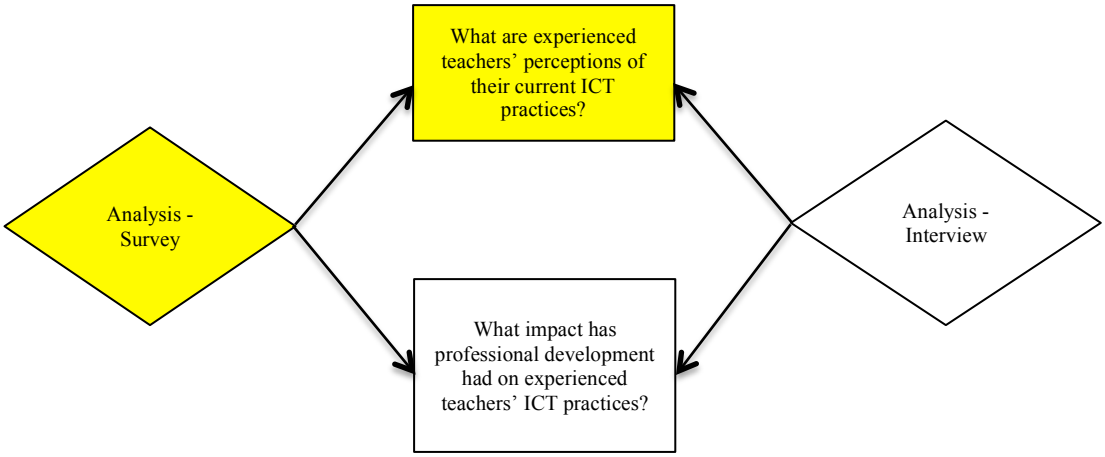


Figure 5.3 Map of survey analysis and research question 1

Survey process

The survey required participants to score how they were using ICTs in relation to the policy *National Professional Standards for Teaching* (AITSL, 2011) and includes five standards incorporating 27 focus areas. This policy outlines what teachers should know and be able to do. The 16 participants gave each *focus area* a score between 1 and 5: a score of 5 was allocated to those focus areas that require *full or total use of ICTs* and a 1 was allocated to those focus areas that require *no use of ICTs*. All participants' scores were collected, totalled and divided by the number of participants to arrive at an average result. These average results were sorted from highest to lowest (see Appendix C for full results).

This calculation resulted in an identification of the focus areas that had the most frequent use of ICTs, the least frequent use of ICTs, the most significant use of ICTs and the least significant use of ICTs.

Analysis of teaching standards

The results from the survey showed that the majority of what a teacher should know and be able to do required a *moderate* use of ICTs. A moderate use would be equivalent to an average score of 3 on the scale of 1 to 5. This is important as it recognises the importance of ensuring that all teachers have the opportunity to develop their use of ICTs to this moderate level. This is also relevant as experienced teachers can be assured that any change to their ICT practices is designed to enhance and support what they do, rather than replace strategies that they may have been using prior to the ICT innovation.

Table 5.2 shows a summary of the results for the five standards with the *average* result shown in the third column. The average result represents a self-reported measure of ICT use necessary for experienced teachers to be able to perform these standards.

Table *5.2 National Professional Standards for Teaching - Use of ICT practices from highest to lowest*

Standard Identifier	**Standard**	**Average result from survey – scale of 5 (frequent use of ICT) to 1 (lowest use of ICT)**
Standard 2	Know the content and how to teach it.	3.20
Standard 5	Assess, provide feedback and report on student learning.	3.13
Standard 3	Plan for and implement effective teaching and learning.	3.09
Standard 1	Know students and how they learn.	2.95
Standard 4	Create and maintain supportive and safe learning environments.	2.72

The results across the five standards only varied by 0.48 on the 5 point scale, as seen in Table 5.2. This small range of difference suggests that teachers are required to use ICT practices across all areas of their duties with similar levels of frequency. This is important because school leaders must ensure that professional development programs focus on the use of ICT practices across all facets of a teacher's role to ensure the continual improvement of teacher quality. The next section provides a deeper analysis by considering the results across all 27 focus areas. (Refer to Appendix C for a full list of results for the five standards divided into the 27 focus areas.)

Analysis of focus areas

Averages provide some analysis, however, a more detailed analysis can be obtained by considering the 27 focus areas. Across these focus areas, the results varied by 28%, which supports the belief that ICTs are used at different levels. The next section analyses which teaching practices had the most frequent and least frequent use of ICTs, followed by an identification of which ICTs are considered to be more significant than others.

Most frequent use of ICTs

The survey results showed that the most frequent use of ICT practices included teachers locating, selecting and creating resources and assessment; developing and implementing teaching strategies to engage students; and reporting on students' progress. The skills required to utilise ICTs in these areas could be described as being relatively straightforward to learn and understand, and are compatible with learning outcomes that have clear observable results (Rogers, 2003). Many of these ICT practices also occur outside the classroom and revolve around planning and reporting as opposed to the implementation of pedagogical practices requiring students to engage in complex, creative and critical thinking (Horizon Report, 2011). When applying the Diffusion of Innovations theory to this concept, the use of ICTs to enhance students' thinking is still a relatively recent innovation across some secondary schools and requires the implementation of specifically designed professional development in order to engage teachers in this change process.

Moderate use of ICTs

The survey results showed that a moderate use of ICT involved teachers organising content into well-sequenced learning and teaching programs; developing engaging teaching activities; developing informal and formal assessment strategies; developing teaching activities that incorporate differentiated strategies; and implementing effective communication strategies (full results are provided in Appendix C). Given that all teachers have their own laptops and are able to use them in their personal time, it would appear that they are growing in their confidence and knowledge of how to embed and integrate ICTs at a moderate level into the majority of their daily practices (Jimoyiannisa & Komis, 2010, p. 4; Maddux et al., 2011, p. 205). This result supports existing research showing that experienced teachers are now adopting, innovating and engaging with ICTs and are enthusiastic about the potential for ICT use in classrooms (Rogers, 2003).

Least frequent use of ICTs

The survey results showed that the lowest use of ICT involved teachers undertaking three specific activities: providing opportunities for students to develop an understanding and respect for our Aboriginal and Torres Strait Islander communities; managing challenging behaviours of all students; and involving parents in learning. The first and third of these involve community partnerships, including parents. The

identification that ICTs are not being used to develop community partnerships is clearly a problem that must be addressed.

Significant use of ICTs

Further analysis of the survey results identified a number of ICT practices that the experienced teachers considered to be more significant than others given their perceived relevance to effective teaching and learning, their benefit to students and/or their importance or regularity of use. This is important as it provides guidance for school leaders in the area of focused professional development to enhance experienced teachers' use of those ICT practices that are considered crucial.

To identify the most significant ICT practices, the analysis process involved identifying verbs that described each of the 27 focus areas from the *National Professional Standards for Teaching* (AITSL, 2011), which are descriptions of what a teacher should know and be able to do. For example, one of the focus areas begins with the verb *report*: "Report clearly, accurately and respectfully to students and parents/carers about student achievement, making use of accurate and reliable records." A count of the frequency of the verbs used across all 27 focus areas were correlated with frequency of use (the full tally of these verbs is shown in Appendix I). This process revealed that the most significant use of ICTs was related to a teacher's work when they are required to implement, design, use, select, create and report.

To further understand and explain these findings, the verbs have been placed on a diagram based on their frequency of use (see Figure 5.4). This diagram assisted in dividing the verbs into one of the four following categories: most frequent, most significant, least frequent and least significant.

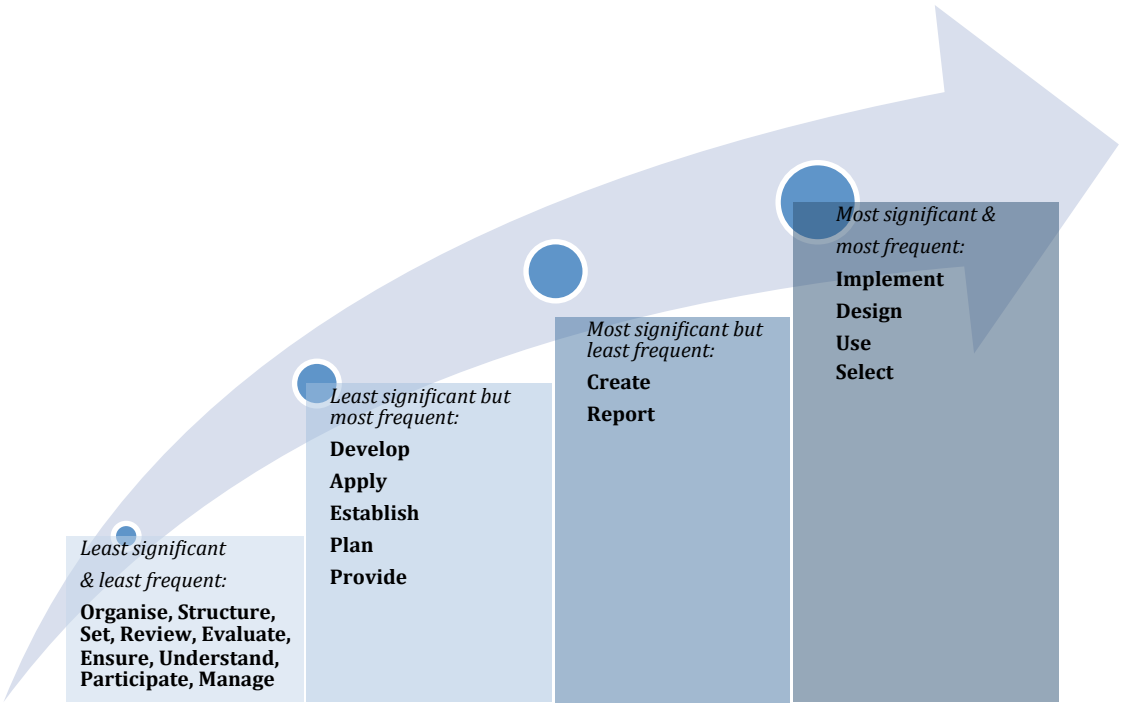


Figure 5.4 Verb frequency and significance

Summary

Those ICTs that were categorised as most significant and frequent are more crucial for a teacher to be able to use due to their importance or regularity of use. This identification of significant and frequent use of ICTs can help to inform school leaders and teachers about how to maximise the use of school resources and time in any professional development program. Given that teachers appear to be struggling with increased demands stemming from a constant improvement agenda (MacDonald, 2008, p. 429; Pollard & Pollard, 2004, p. 150), conflicting priorities and the changing face of technology, it is timely to accurately analyse how teachers are using ICTs. This research informs future professional development agendas in relation to teachers' use of ICTs: it specifically suggests that the ICT practices identified as most significant and frequent should be prioritised in any professional development programs over those identified as least significant or least frequent.

The next section presents an analysis of the results from the interviews. This analysis supports and extends experienced teachers' perceptions of their current ICT practices by focusing on whole-school perspectives and the school's ICT culture. This analysis also contextualises these results by referencing the conceptual frameworks on

which this study is based, namely Roger's *Diffusions of Innovations* (Rogers, 2003) and Tearle's *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004).

5.4.2 Experienced teachers' perceptions of their current ICT practices: interview analysis

This section analyses the interview results that identify experienced teachers' perceptions of their current ICT practices (see Figure 5.5).

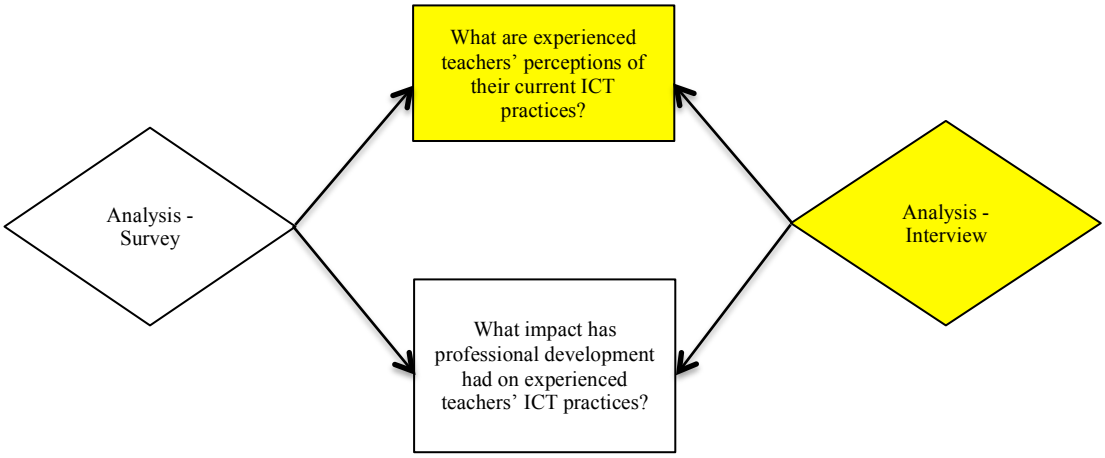


Figure 5.5 Map of interview analysis with research question 1

This analysis identifies the primary use of ICTs and the changing nature of ICT practices from a whole-school perspective. In support of the survey data, the interview results also show that the primary use of ICTs by teachers occurs outside the classroom. This finding is supported by the literature, which shows that there has been little change to ICT pedagogical practice in two decades, and that teachers change their ICT practices somewhat slowly (Dunn & Rakes, 2010; Jamieson-Proctor & Finger, 2010; Sipila, 2012).

Primary use of ICTs

This section analyses experienced teachers' perceptions of their current ICT practices to identify the primary use of ICTs linked to the *National Professional Standards for Teaching* (AITSL, 2011) and other policy documents. Primary use of ICTs identifies which ICT practices experienced teachers are using most frequently to carry out their duties. Included in the analysis are vignettes from the data that provide context for the reader (Stake, 1995).

Interview process

The participants were all experienced secondary teachers from a range of teaching areas, including English, studies of society and the environment (SOSE), science, maths, languages, visual arts and business. Three teachers were regular users of laptop, desktop or tablet computers, two used them sometimes and one was not able to access adequate technology regularly enough. Four teachers had problems accessing adequate technology to meet their needs, although a policy is in place to allow students to *bring your own device* (BYOD). BYOD is an emerging policy where students are allowed to connect their own personally owned computers or tablets to a school's network and use for learning purposes. One teacher did not encourage this practice, one teacher encouraged all year levels to BYOD and four teachers encouraged only senior students to BYOD.

Participants were asked to identify their primary use of ICTs in their practice in relation to administration, curriculum planning, curriculum implementation, assessment and communication. These five categories were selected after considering a range of policies that inform teachers' responsibilities and duties. Some were school-based policies, and others were federal and state government policies, including:

- Digital Education Revolution (DEEWR, 2008)
- ACARA – Shape of the National Curriculum – ICT Capabilities (ACARA, 2012)
- Smart Classrooms Policy (EQ, 2012)

The school and government policy documents were used to provide a contrast or to support to the survey data, which focused solely on the *National Professional Standards for Teaching* (AITSL, 2011). In addition, these policies were chosen because of the changing nature of ICTs in classrooms. For example, policies are regularly updated or replaced with new policies and hardware and software suitable for classroom use are also regularly updated. This theme of *Changing and evolving use of ICTs* in classrooms is consistent in this study and it has been widely identified in other research (Horizon Report, 2011; Starkey, 2011) (see Section 6.2.3 for further discussion on this theme).

Analysis of primary use of ICTs

Selections of sample responses about primary use of ICTs are provided in Table 5.3. These sample responses have been selected because they were frequently

mentioned or were emphasised by the participants during the interviews. Following this, the responses were tallied in order to identify the primary uses of ICTs.

Table *5.3 Primary use of ICTs*

Category of use	**Sample Responses for "identify your primary use of ICTs based on the following five categories: Administration, Curriculum Planning, Curriculum Implementation, Assessment and Communication".**
Administration	• email • research and program writing • enter data into OneSchool*, maintain a diary, use iPad apps • complete differentiation plans • take electronic rolls • I use ICTs for everything as I try to operate paper free • I keep spreadsheet records for data analysis
Curriculum planning	• email students, plan lessons and units • research of best pedagogical practice • find resources, photograph and scan older print resources, plan lessons and units, OneNote is difficult to use due to lack of familiarity • plan lessons and units on OneSchool • create PowerPoint for lesson preparation, specialist software • access units on OneSchool, find resources
Curriculum implementation	• reinforce learning for students, prepare and use academic games • use videos, data projector, PowerPoint • use specialist software, conduct inquiry and internet research • show PowerPoint, identify online resources, use data projector, take photographs, organise students files • use data projector, specialist software, automate simple processes, which leaves time for analysis and higher order thinking
Assessment	• record audio files for students to listen to • ICTs allow for self-paced and differentiated learning • record audio and video of students' presentations, feedback, differentiated learning • email students, feedback to students in Microsoft Word using the review and tracking feature, digital submission of junior assignments to mark online,

	conserve paper • would like to use Microsoft Excel or spreadsheet software, but it's too difficult • expect students to submit word-processed assignments, teach students specific technical skills and advanced features in Microsoft Word, LearningPlace stores assessment items, revision sheets, allows parents' access • email students, digital submission of assessment files, mark online, use spreadsheets to track students' results
Communication	• email students' homework: students mainly access private email accounts • email colleagues • emailing parents is the preferred method of communication as it is more efficient • provide feedback to students in Microsoft Word and can copy email to parents and keeps a record of message given to parents • use LearningPlace to give feedback to students easily

*OneSchool is a web-based database developed by Education Queensland that provides student information throughout a students' schooling in the Queensland state education system. It includes personal, medical, family, behavioural, academic, attendance and special education or learning support needs, among other information.

Tally of primary use of ICTs

Based on the responses, a tally was collated to identify the primary uses of ICTs (see Table 5.4).

Table *5.4 Tally of primary use of ICTs*

Teacher duties	Frequency of use	Percentage of overall use
Planning	24	32.00%
Communication	24	32.00%
Implementation	13	17.30%
Assessment	10	13.30%
Administration	4	5.30%
Total	75	100.00%

Frequency of use was calculated by tallying the number of times these duties were mentioned during the interviews. Percentage of overall use was calculated by dividing the frequency of use for each duty by the total number of times these duties

were mentioned during the interviews.

This data allowed for a breakdown based on whether these activities were usually performed inside or outside the classroom. The use of ICTs to carry out implementation and assessment duties generally occurs *inside* the classroom, and from Table 5.4, this equates to 31% of ICT use. Importantly, the data indicates that experienced teachers' perceptions of their current ICT practices were primarily related to duties that occur *outside* the classroom: planning, communication and administration. From Table 5.4, this equates to 69% of ICT use. In addition to this, all participants stated that the use of ICTs via email and digital feedback given to students using *mark-ups* in Microsoft Word was part of their common assessment duties, which also occurs outside the classroom.

The data clearly identifies that the primary use of ICTs occurs outside the classroom, which supports the literature that has shown this to be the case for decades, even in the face of significant policy change (Cuban, 1986, 2001; Dunn & Rakes, 2010; Hurd, 2009; McGarr, 2009; Queensland Government, 2011). Nonetheless, policy writers, school leaders and teachers are required to identify and develop teachers' ICT practices for use within a classroom, particularly in the area of implementation. This theme will be discussed and in more detail in Chapter 6.

National Professional Standards for Teaching

To support the survey questions, participants were asked in the interviews to provide examples of how ICTs helped them to meet the National Professional Standards for Teaching (see Appendix A for the five standards and 27 focus areas). Some example responses are provided in this section, along with supporting analysis.

Standard: 1 Know students and how they learn. The most frequent ICT practice in this standard was to locate information about students through accessing databases with details including attendance, behaviour, academic results, learning difficulties, learning preferences, medical and family information. This includes information on how students learn such as differentiation plans, learning improvement plans and temperaments profiles showing preferred learning styles. Teachers reported that using ICTs via databases to know students and how they learn improves relationships and communication with students, which results in an improvement in

students' engagement (Hattie, 2009; Jimoyiannisa & Komis, 2010; MacDonald, 2008; Pollard & Pollard, 2004; Starkey, 2011).

According to Participant 4, "ICTs allow teachers to know their students more efficiently; however, teachers are expected to adapt to the latest system to gather and retrieve information on students". Constantly evolving databases, which contain student information, require teachers to learn new ICT skills (Theisens et al., 2010). For some experienced teachers, this constant cycle of change is overwhelming, but for others, it is expected and simple to adapt to (McGarr, 2009; Pollard & Pollard, 2004). This theme of *Changing and evolving use of ICTs* is further discussed in Section 6.2.2.

Standard 2: Know the content and how to teach it. The primary use of ICTs in this standard was to research and gather resources locally, nationally and internationally. Participant 3 stated, "As an experienced teacher, ICTs are used to digitise older resources". Participant 4 stated, "In their field you have to stay current with ICTs and specialist software, otherwise you are ineffective". This participant also said "I need to build more technical skills in order to utilise ICTs more effectively". All participants noted the need to constantly evolve their ICT practices.

Standard 3: Plan for and implement effective teaching and learning. When asked how ICTs helped teachers to plan and implement effective teaching and learning, each participant responded differently and there was no pattern or theme. Responses were varied and included helping teachers to perform the following: engage boys, plan and implement differentiation strategies, compose emails and be more efficient.

Standard 4: Create and maintain supportive and safe learning environments. Participants frequently responded that they had concerns about the online safety of students and that any student use of ICTs in classrooms was closely monitored (Horizon Report, 2011; Maddux et al., 2011). According to Participant 6: "You need to be monitoring ICT use closely and talk to students and the class about their use. It is not a concern as long as you are vigilant." According to Participant 4: "I'm very concerned about online safety and I'm always asking students what they are doing or accessing. I'm more vigilant with junior students." Participant 2 said that "there are issues with safety in emails, concerns with Facebook and issues of cyber bullying" and that "there is a need to have and use classroom monitoring software".

This is another example where participants noted the need to constantly change their ICT practices. It was identified that if teachers had their own personal interest in ICTs in relation to online and social media use, then personal use at home was an effective method of professional development, which can then be transferred to the professional teaching and learning environment (Jimoyiannisa & Komis, 2010; Maddux et al., 2011; Wachira & Keengwe, 2011). This idea links to the themes of (1) *Changing and evolving forms of professional development for learning ICTs* and (2) *Promoting alternative forms of professional development.* These themes will be discussed further in Chapter 6.

Standard 5: Assess, provide feedback and report on student learning. All participants responded that they used email and Microsoft Word's reviewing feature to modify documents and communicate feedback to students. Participant 3 said: "I use email to send feedback to students and send a copy of the email to parents." Participant 5 said: "I use ICTs to record or photograph student's work and then email feedback." Interestingly, while students are provided with school-based email accounts, many do not regularly use or check their school email. Teachers stated that they collected students' personal email addresses because this was the primary email account that students may access for school, work and personal use. Teachers also reported the use of online learning environments such as content management systems or virtual classrooms as an alternative method of assessment or feedback. Some teachers were reluctant to engage with virtual classrooms, due to previous technical difficulties or due to the need to constantly update the online system and learn new processes. However, two participants said they preferred the use of online virtual classroom environments to ensure that assessment was efficiently tracked.

A constant thread throughout this analysis and this section was the frequency with which teachers talked about the constant and rapid cycle of change in relation to ICT practices. This topic is analysed in the next section.

Analysis of changing and evolving ICT practices and the conceptual frameworks

In the next section of the interview, teachers were asked about changing ICT practices. This section reports and analyses the changes that have taken place from the participants' perspectives, focusing on both the individual and the organisation, specifically focusing on the two conceptual frameworks, which provide a theoretical

foundation to the analysis. The first conceptual framework is *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004). The second conceptual framework is *Diffusions of Innovations* (Rogers, 2003)

Tearle's theoretical and instrumental framework for implementing change in ICT in education

The participants were asked questions based on Tearle's *A theoretical and instrumental framework for implementing change in ICT in education* (2004). This framework provides a model for the factors to consider when implementing ICT changes in a school and is relevant to this research due to the fact that school leaders have to consider whole-school ICT culture as well as processes in order to professionally develop staff in the area of ICT practices. This framework includes the following factors:

- The whole-school characteristics
- The ICT implementation process
- Individuals.

The whole-school characteristics

Whole-school vision and a positive learning culture are vital to change and explicit improvement agendas. The teachers were asked if the school had a collaboratively developed culture that encouraged ICT implementation. Four teachers responded that there was a clear culture to encourage ICT implementation, one teacher was unsure and one stated there was no culture to encourage ICT implementation. The teachers were asked if they believed the leadership and senior management of the school promoted the use of ICT implementation and all agreed with this statement. Three identified that school leaders' understanding of ICTs was also evolving, and therefore, they may not be cognizant of current ICT practices, challenges or successes. The participants highlighted the need for teachers to *Upward manage and skill the schools' leaders* (Darling-Hammond & Richardson, 2009; Drent & Meelissen, 2008; Fullan, 2002; Gilbert, 2011; Rogers, 2003; Wachira & Keengwe, 2011) and this recurring theme is further discussed in Chapter 6.

The ICT implementation process

Teachers were asked if they believed the school had well-established processes to facilitate change in teachers' ICT practices. Four teachers felt that there were inadequate processes and cited inadequate funding, lack of leadership, inequitable

access to technology and slow resolution of technical issues (Drent & Meelissen, 2008; Wachira & Keengwe, 2011). Five teachers stated that technical support structures were in place and the technicians were invaluable; nevertheless, these support staff are generally overwhelmed due to the size of the school and the number of technical problems. Teachers also commented that much of the professional development offered used *a one-size fits all approach* and that teachers were unable to obtain individualised support (Darling-Hammond & Bransford, 2005; Guskey & Huberman, 1995; Wells, 2007). Professional development practices are analysed in detail in the Section 5.5 and the theme of *Changing and evolving professional development for ICTs* is discussed in Chapter 6.

Individuals

Teachers were asked if they believed they received adequate recognition of the time it takes to learn and adopt emerging ICT practices. Results were divided, with three teachers agreeing that there was and three teachers disagreeing. Participant 3 said: "I balance any time allocated by putting in my own time." Participant 5 said: "I make sure that the Principal and Heads of Department know my interests and skill areas and I promote the outcomes so that recognition and support is ongoing." In contrast, Participant 1 said, "If you have skills you are expected to mentor other staff without an allocation of time" and Participant 6 said that "generally younger teachers adapt [more easily] and more experienced teachers need more support".

Teachers were asked if they were motivated to change their ICT practices, and if so, what motivated them. All six teachers stated that they were motivated to change and develop and that innovations such as iPads and BYOD were sources of inspiration. However, they all commented that they felt it was expected and necessary to change and evolve their ICT practices. Other frequently mentioned reasons to change included a personal interest in ICTs, that ICTs result in an improvement in effectiveness and efficiency, a belief that ICTs were necessary for future careers for students and a belief that ICTs increased students' engagement. Several teachers mentioned obstacles that decreased their motivation to change their ICT practices and these included other school priorities, such as NAPLAN preparation and testing and a lack of time to fully engage in professional development and to trial and test new ICTs in the classroom.

In addition to Tearle's *A Theoretical and instrumental framework for implementing change in ICT in education* (2004), Rogers' Diffusion of Innovations (2003) framework can assist school leaders in managing change within a school. Rogers' framework specifically focuses on the change management process of Innovations, such as ICT practices, and is discussed next.

Rogers' Diffusion of Innovations: Attributes of Innovations

Teachers were asked questions based on Rogers' (2003) Diffusion of Innovations change process theory on the Attributes of Innovations. This included what role the following items played in teachers' ability to change or adopt new ICT practices:

- relative advantage
- compatibility
- simplicity and ease of use
- trialability
- observable results
- reinvention.

Relative advantage

This refers to the degree to which teachers believe that using ICT practices enhances learning. The theory states that if teachers identify a relative advantage they are more likely to adopt the innovation. All six teachers responded that ICTs enhanced teaching, with four teachers specifically stating that it increased the range of teaching strategies that can be used. However, two teachers stated that when the use of ICTs was not contextualised into a learning outcome, then they would generally not adopt the ICT for classroom use. To persuade teachers to change their ICT practices, school leaders must promote and persuade teachers to see the relative advantage. If there is no relative advantage, it is likely the innovation will not be adopted.

Compatibility

Refers to the degree to which teachers believe ICT practices are consistent with the values, experiences and needs that teachers have. All six teachers stated that using ICT practices was consistent with their values, experiences and the needs they have as a teacher (Dunn & Rakes, 2010; Hixon & Buckenmeyer, 2009; Norton, 2011; OECD, 2010) and that using ICTs appealed to students. To persuade teachers to change their

ICT practices, school leaders must ensure that any innovation is compatible with experienced teachers' beliefs and values. The limitation in this area is that teachers will likely have a wide variety of values, experience and needs, particularly given that secondary schools have a range of specialist faculty areas. This supports the concept that any professional development program must be differentiated for particular staff based on their current level of ability and motivation in the area of ICT practices.

Simplicity and ease of use

This refers to the perception that ICT practices are either simple or difficult to understand and use. Five teachers stated that ICT practices were both difficult and simple to use. This statement demonstrates the diversity of ICT practices available and the differing levels of skills required. Difficult ICT practices included being restricted by Education Queensland's internet filtering systems, the use of technical language, which can cause confusion, and the high prevalence of hardware problems or faults (Bingimalis, 2009; Petras, 2010; Schoepp, 2005; Wachira & Keengwe, 2011). Participant 6 said: "I'm not interested in learning about hardware, so if the hardware does not work, I'm at a loss." Simple ICT practices included using data projectors, showing YouTube videos, using Google for inquiry and research, using Photoshop for image manipulation, accessing the Learning Place and other content management systems for information and using PowerPoint to present information. One teacher responded that all ICT practices were difficult: "I'm lacking in the foundation technical language, which makes it more difficult to learn." Again, this highlights the concept that professional development programs must be differentiated for particular staff based on a teacher's current level of ability and motivation in the area of ICT practices.

Trialability

Trialability refers to the degree to which teachers are able to experiment with the use of ICT practice in classrooms without any negative impact. Five of the six teachers responded that they were able to experiment with ICT practices in both senior and junior classes (Ertmer & Ottenbreit-Leftwich, 2010). Teachers responded that they allowed students to experiment with new technologies and offer peer support to each other. One teacher responded that trial and error was time consuming, disruptive to learning and not a priority (Pearson & Naylor, 2006; Petras, 2010). This links to Tearle's *A theoretical and instrumental framework for implementing change in ICT in*

education in particular, the aspect of developing the whole-school ICT culture (2004). Tearle suggests that if a school's leaders encourage innovation and risk taking in the area of ICT practices, teachers are more likely to evolve in the use of ICT practices (2004). The onus here is on the school leaders to ensure that teachers feel encouraged to try new methods and reflect on their success without any detriment to students' learning.

Observable results

This refers to the practice of observing another teacher's ICT practice and if this results in changing current ICT practices. Four teachers responded that they had observed another teacher's practice and that this had changed their own ICT practices. Five teachers said that viewing other teachers' practices helped to inspire new ideas (Darling-Hammond & Richardson, 2009; Garet et al., 2001; Jayaram, Moffit & Scott, 2012). The remaining teacher said, "seeing other teachers ICT practices can have a negative impact as it makes me feel incompetent". *Promoting the value of alternative types of professional development,* of which formal observation is one such strategy, is discussed in detail in Section 5.5.1.

5.4.3 Summary

To summarise this section on experienced teachers' perceptions of their current ICT practices, the following themes were identified and they are discussed in more detail in Chapter 6:

- Primary use of ICTs outside the classroom (see Section 6.2.1)
- Changing and evolving use of ICTs (see Section 6.2.2)
- Upward management and skilling of school leaders (see Section 6.2.3).

This concludes the analysis of the first research question. The next section of the analysis focuses on the second research question.

5.5 Analysis of the impact of professional development on experienced teachers' ICT practices

This section analyses the results from both instruments and focuses specifically on the second research question: What impact has professional development had on experienced teachers' ICT practices? This is necessary to gain a more accurate understanding of which professional development methods are being accessed by experienced teachers and what the resulting impact is. The analysis includes discussion on the types of professional development that are available, are more frequently attended, have the highest impact on changing a teacher's ICT practices and can be categorised as underutilised. Understanding the impact of professional development will assist school leaders and teachers in designing professional development programs that will improve teachers' ICT practices. The next section analyses the results from the survey and the following section analyses results from the interview.

5.5.1 The impact of professional development on experienced teachers' ICT practices: survey analysis

This section analyses the results from the survey to address the second research question, as depicted in Figure 5.6.

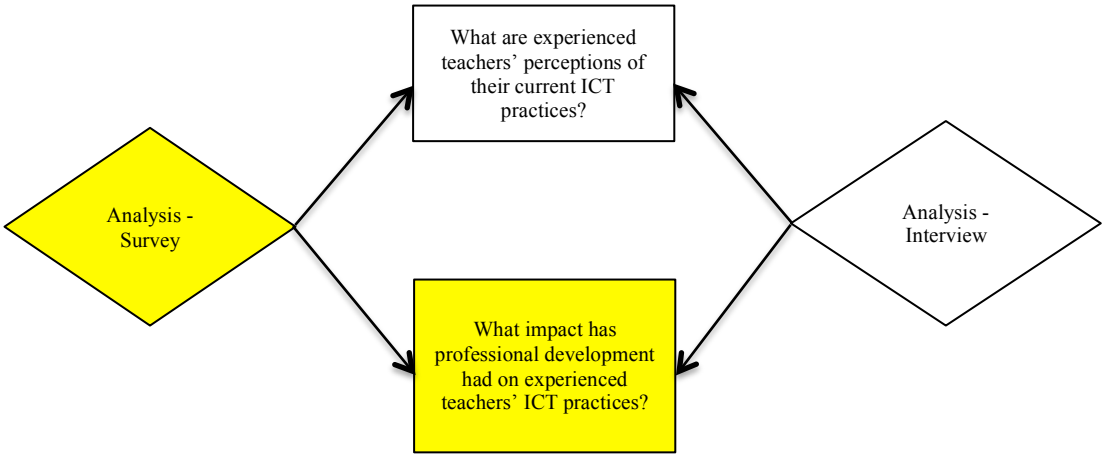


Figure 5.6 Map of survey analysis with research question 2

Survey process

The survey initially asked teachers to identify the types of professional development that they most frequently attended or accessed on a scale of 1 to 5, with 1 representing *infrequent access* (e.g. once or twice per year) and 5 being *frequent access* (e.g. weekly or daily). The variety of professional development methods accessed by teachers who are learning about ICT practices highlights the diversity of learning opportunities that teachers continually engage with (Gilbert, 2011; Petrie & McGee, 2012). Teachers could choose from 23 types of professional development opportunities and were asked to identify the impact that these different methods of professional development had on their ICT practice. Impact was defined as a transformation of a teachers' ICT practices, meaning that a positive change or improvement occurred. This identification of impact was on a scale of 1 to 5, with 1 representing *no impact* and 5 representing a major change identified as a *total impact*. The results for all 23 types of professional development from the 16 survey participants were collated, totalled and averaged with a score out of 5.00. Each type of professional development was given an average score out of 5.00 for:

- frequency of attendance
- impact.

Analysis of the results showed the professional development methods that were more frequently accessed, had the highest impact, had the least impact, and were underutilised. The methods categorised as underutilised were those that had a high impact, but were not frequently attended. This is significant as school leaders can design professional development programs based on those methods that have the highest impact and can increase the frequency of attendance at those currently considered underutilised. In addition, the information is useful because school leaders can minimise the use of, or improve the delivery of, those methods that have the least impact. These four concepts related to frequency of use and impact are discussed in the next four sections of the analysis.

Analysis of professional development types that were most frequently attended or accessed

Twenty-three types of professional development were identified in the survey and from this list, experienced teachers identified how frequently they attended or accessed professional development on ICTs. An average result for each type of

professional development was calculated and then this list was sorted into those types of professional development that were most frequently attended to those that were least attended. This full list and average scores are shown in Appendix C (see Survey Data, Question 6). The professional development attended or accessed most frequently was *self-taught trial and error*, which scored an average result of 3.5 and indicates that teachers were accessing this type of professional development every six weeks. The least frequent method of professional development was a *structured online course*, which scored an average of 1.25. This indicates that teachers are accessing this type of professional development once per year or not at all. Table 5.5 shows the five types of professional development on ICTs that were attended or accessed most frequently.

Table *5.5 Types of professional development most frequently attended or accessed*

PD identifier number (from survey)	**Types of professional development most frequently attended or accessed**	**Average result from all 16 participants on a scale of 1 (once or twice per year) to 5 (weekly or daily)**
21.	Self-taught trial and error	3.50
18.	Personal use at home	3.38
19.	Learning from family or friends	3.13
10.	Peer mentoring from colleague in own faculty	2.81
20.	Learning from students	2.81

These categories of professional development have characteristics that match the preferred methods of professional development listed in the literature, including informal nature, flexible delivery, self-initiated, self-paced, accessible, learning from others who are familiar to them, low or no cost to attend, and no loss of class contact or teaching time (Gilbert, 2011; Jayaram, Moffit & Scott, 2012; Wells, 2007). When teachers are empowered to undertake their own development and learn from their peers and from students, the literature also suggests that they model life-long learning, which benefits collegial and teacher–student relationships and is also known to improve the engagement of students (Hattie, 2009). However, the frequency of attendance at professional development does not necessarily equate to a change in or impact to ICT practices. In the following section of analysis, the types of professional development that had the highest impact are discussed.

Analysis of professional development with the highest impact

Impact can be measured in a number of ways and the focus for this question relates predominately to a *change* in professional practice. Participants were required to identify which professional developments had an impact on their ICT practices. The scale of the impact ranged from 1 to 5, with 1 representing *no impact* and 5 representing *total impact*. Total impact is defined as a transformation of the use of ICT practices. The type of professional development with the highest impact was *structured online course*, which scored an average of 3.4 from all 16 participants. A score of 3.4 is identified as a moderate impact, which means there had been considerable change, yet not a complete change to the existing practice. The type of professional development that had the lowest impact was *learning from your direct supervisor and social media*, which scored an average of 2.0 and is identified as having a minor impact. A minor impact means that a small amount of change may have been made, but this may not continue in the long-term. Table 5.6 shows the five types of professional development that resulted in the highest impact on experienced teachers' ICT practices.

Table *5.6 Types of professional development that had the highest impact on ICT practices*

PD identifier number (from survey)	Types of professional development that had the highest impact on ICT practices	Average result from all 16 participants on a scale of 1 (No impact) to 5 (Total impact)
6.	Structured online course	3.40
5.	External course or workshop	3.17
21.	Self-taught trial and error	3.13
18.	Personal use at home	3.13
19.	Learning from family or friends	3.07

The characteristics that are common to these high-impact types of professional development are that they occur outside of the school; do not include any other staff from the school and are generally of a self-paced and/or self-initiated nature.

Comparison of frequency and impact

Comparing the results about frequency of attendance with the results about the impact that the professional development had on a teacher's ICT practices revealed that three types of professional development were in the top five in both lists:

- self-taught trial and error

- personal use at home
- learning from family and friends.

Given that these types of professional development were frequently accessed and also had an impact on the use of ICT practices, their use should be encouraged and supported. This recommendation is supported by research that states that teachers' personal use of technology in their home or personal lives contributes towards their use of technology in their classroom (Jimoyiannisa & Komis, 2010; Maddux et al., 2011). This comparison of results for frequency and impact also led to the identification of several types of professional development that were identified as underutilised and they are discussed in the following section.

Analysis of underutilised forms of professional development

As identified in the above list, the professional development method of *structured online course* had the highest impact on experienced teachers' ICT practices, yet had the lowest frequency of attendance. It is suggested that this type of professional development is underutilised, and given its higher rate of impact, more opportunities for teachers to engage in this method of professional development should be investigated. The five types of professional development that had the biggest variation, where results for *impact* were higher than results for *frequency* are shown in Table 5.7.

Table *5.7 Types of professional development categorised as underutilised*

PD identifier number	Types of professional development categorised as underutilised	Part A: Frequency of types of PD	Part B: Impact of PD	Difference: impact > frequency
6.	Structured online course	1.25	3.40	2.15
5.	External course or workshop	1.44	3.17	1.73
14.	Formal observation of another colleagues' practice	1.31	2.75	1.44
4.	Conference	1.50	2.70	1.20
12.	Peer mentoring from school technicians	1.88	2.92	1.04

Some possible reasons for these types of professional development not being more frequently attended or accessed are:

- limited amounts of funding allocated to a professional development budget

- attendance at professional development resulting in a loss of class contact teaching time
- professional development unsupported by a school's administration, resulting in no approval to attend the requested professional development
- conflicting school priorities
- reliance on traditional forms of professional development or a school's ICT culture.

This last example is particularly evident in the case of peer mentoring from school technicians, which may not be encouraged or may not be part of a school technician's normal duties (Bingimalis, 2009; Gilbert, 2011; Petras, 2010; Schoepp, 2005). While financial and human resources must be considered across any organisation, the data suggests that two types of professional development from the list above are sustainable, affordable and effective and should therefore be encouraged. Both forms of professional development are discussed in more detail below.

Formal observation of another colleague's practice

Encouraging formal observation of another colleague's practice creates a mentoring and coaching model of professional development. This model provides observers with a guided set of questions and reflection activities and has been found to result in positive changes in a teacher's practice (Brown-Easton, 2008; Darling-Hammond & Richardson, 2009; Garet et al., 2001). There are several minor logistical problems involved in implementing this program and they chiefly relate to timetabling and the internal relief of teachers. However, resource-allocation models used in secondary schools do not always allow this to occur. For this to be implemented, this schools' leadership team may need to be persuaded that these alternative methods of professional development are viable and result in a positive impact.

Peer mentoring from school technicians

School technicians are primarily employed to manage ICT infrastructure, provide technical support and resolve technical issues. However, they are also an underutilised resource in relation to developing teachers' ICT practices. School technicians have an extensive knowledge of technology as well as the ability to learn new technology quickly. These abilities could help teachers through a peer mentoring

and coaching model (Darling-Hammond & Richardson, 2009; Garet et al., 2001). To encourage this within this particular school, a whole-school culture change would be required.

Both of these recommendations link to three themes that have become evident during this research: *Upward management and skilling of school leaders*, *Changing and evolving professional development for ICTs* and *promoting the value of alternative types of professional development. Upward management and skilling of school leaders is essential in any change management process as the school leaders form strategic priorities managing budgets and resources, in addition to influencing and inspiring others to change and lead PD programs.* These topics will be discussed in more detail in Chapter 6.

Analysis of professional development types that have the least impact

An important part of any professional development program in a school or organisation is to evaluate the effectiveness of individual professional development sessions or methods because such an evaluation assists the leaders in designing and implementing future professional development programs. The results from the survey provided a list of professional development that participants identified as having the least impact (see Table 5.8 for the three with the lowest impact). School leaders can either discourage these low-impact methods of professional development or reflect on how these methods could be more effectively utilised to produce a higher impact, which is clearly an area to be explored in future research. The lack of context, collaboration and follow-up (aspects that are not usually prevalent in meetings or on social media) could explain why these low-impact methods have had such a minor impact on teachers' ICT practices (Borko, 2004; Guskey & Huberman, 1995; Mishra & Koehler, 2006; Wells, 2007). However, other reasons for their appearance on this list are offered in the next section.

Table *5.8 Types of professional development that had the least impact on ICT practices*

PD identifier number (from survey)	Types of professional development that had the least impact on ICT practices	Average result from all 16 participants on a scale of 1 (No impact) to 5 (Total impact)
1.	Domain meetings where colleague/s led a session on ICT practices	2.38

9.	Learning from your direct supervisor (e.g. Head of Department or Deputy Principal)	2.00
23.	Social media (e.g. Twitter or Facebook)	2.00

Domain meetings in which colleague/s led a session on ICT practices

These meetings usually take place every month for one hour after school and are led by the Head of Department. There can be anywhere from 10 to 40 teachers in attendance. If ICT professional development is on the agenda, it is usually to demonstrate the use of ICT practices. Fullan (1995) maintains that demonstrating the practice on its own, without an opportunity for teachers to collaborate, practice or reflect on its use, will have no impact on teachers' practices; therefore, school leaders need to be aware of this lack of impact so that valuable meeting time and resources are more fully utilised.

Learning from direct supervisor

The appearance of this method of professional development on this list creates an opportunity for reform as it is the supervisor's role is to lead, persuade, manage and mentor staff. The literature reinforces the fact that effective professional development occurs when there is support from peers and leaders (Guskey & Huberman, 1995; Guskey & Yoon, 2009; Wells, 2007). It is therefore recommended that Heads of Department and Deputy Principals reflect on the influence they are having on their staff, the support they are providing and the need to evaluate solutions to address this problem. This is also an opportunity to ensure that school leaders have the necessary skills in ICT practices and mentoring processes, and develop strategies to improve performance in this area. This is the foundation for further analysis in Section 6.2.3.

Social media

Education Queensland has encouraged the use of professional learning networks and online communities (Education Queensland, 2011), such as Twitter through the Learning Place and conferences, and some teachers engage in this form of professional development. However, teachers at the site of this research appear to have been relatively slow to adopt this method and it is therefore not surprising that in their responses the impact of this professional development is minimal. The reasons for the slow uptake and minimal impact could relate to the whole-school ICT culture and the fact that the development of ICT practices is prioritised after literacy, numeracy, reading and academic achievement.

These results and the identification of the types of professional development with the least impact in teachers' ICT practices links to the theme of *Upward management and skilling of school leaders* because these professional development methods involve the school's leaders and whole-school ICT culture. This theme will be further discussed in Chapter 6.

Summary

The identification of significant and frequent use of ICTs can help to inform school leaders and teachers, and allow them to maximise the use of school resources and time in terms of professional development programs offered. Clearly, ICT practices identified as most significant and frequent should be given priority in professional development programs because the data from this research indicates that teachers are struggling with new demands from a constant improvement agenda (MacDonald, 2008, p. 429; Pollard & Pollard, 2004, p. 150), conflicting priorities and the changing face of technology. This section of data analysis has provided a foundation for future professional development agendas in relation to teachers' use of ICTs. In the next section, an analysis of the results from the interviews is presented, which supports and extends experienced teachers' perceptions of their current ICT practices by focusing on whole-school perspectives and the school's ICT culture.

5.5.2 The impact of professional development on experienced teachers' ICT practices: interview analysis

This section analyses the results from the interviews to address the second research question, which focuses on the impact of professional development on practice (see Figure 5.7).

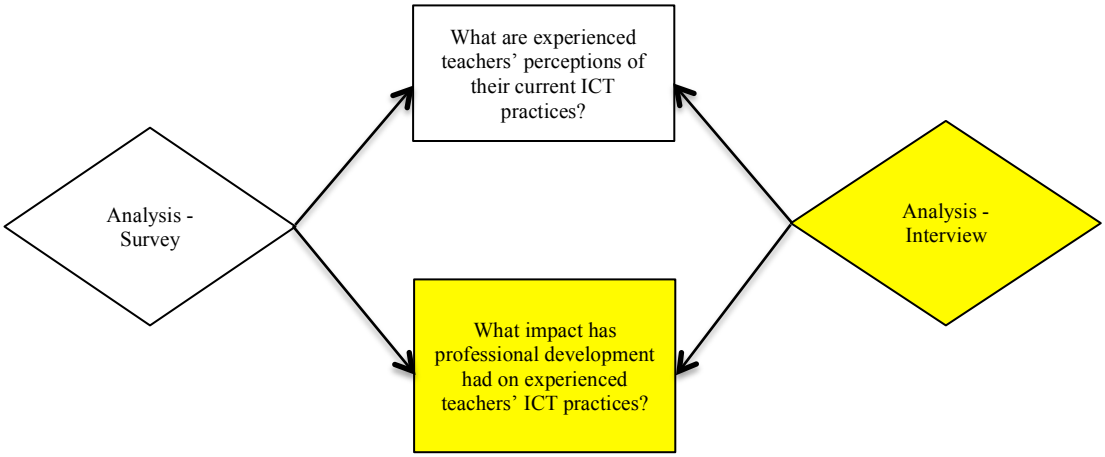


Figure 5.7 Map of interview and research question 2

Following on from the survey analysis outlined in the previous section, this section analyses results from the interviews, specifically in relation to the second research question. The analysis explores the preferred types of professional development; features common to preferred professional development; teachers' attitudes and perceptions towards professional development; and what challenges and barriers experienced teachers face in order to further implement ICTs in the classroom. Timperley (2011) suggests that if professional development is to have a positive impact on teachers' ICT practices, the professional development program must contain a number of essential features, teachers must be engaged in the process, and barriers preventing change must be identified. Each of these three concepts is examined in more detail in the next sections.

Analysis of features of professional development

The interview questions for this section specifically set out to identify which method of professional development experienced teachers preferred in terms of developing and enhancing their ICT practices. Importantly, the data showed that no one type of professional development was preferred. Rather, the teachers described a number of key features of professional development that they preferred, each of which is analysed and discussed in this section. In addition, this section touches on how professional development has affected these teachers' attitudes towards ICTs and which type of professional development had the biggest impact on their ICT practices.

First, teachers were asked in the interviews to describe their preferred type of professional development for learning about ICT practices. Rather than identify a method of professional development, all of the teachers used multiple descriptive terms to identify features of professional development that were preferred. To help analyse and frame this data set, each of the descriptive terms was tallied to determine frequency. This resulted in the ranking of preferred features/types of professional development. Table 5.9 shows the list of descriptive terms used and their frequency.

Table *5.9 Descriptive terms used for preferred type of professional development*

Descriptive terms used for preferred type of professional development	**Tally: number of times descriptive term was mentioned**
Hands-on	4
Small group	3
Practice time	3

Demonstration	3
Internal presenter	2
External presenter	1
Expert presenter	1
Follow-up	1
Time to trial in classrooms	1
Use school technicians	1
Helpful presenter	1

These descriptive terms can add to the body of research on the features of effective professional development, which currently include contextual, collaborative and engaging (Gilbert, 2011; Guskey & Yoon, 2009; Wells, 2007). The preferred features found in this research include hands-on activities, small groups of teachers, practice time and demonstrations of the ICT practices. Responses varied considerably with representative examples including Participant 6 saying, "hands-on, no lectures, demonstration and practice time, internal presenters are good for follow-up and small groups are better" and Participant 5 saying, "Hands on, trialling in classroom, demonstration and practice time". An important aspect that emerged from this set of interviews was that large high schools have the logistical dilemma of providing professional development for large numbers of teaching staff and small-group professional development sessions are seen as resource-intensive. There is, however, an opportunity for groups of engaged and motivated teachers to lead this professional development and not rely solely on the school leaders to organise and deliver professional development programs. There is also an opportunity to promote the concept of *trialability* (Rogers, 2003), in which practice, risk taking and innovation can further increase a teacher's motivation and improve the whole-school culture of learning (Ertmer & Ottenbreit-Leftwich, 2010).

Second, teachers were asked to describe how attending professional development on ICTs affected their teaching. Four of the six participants stated that professional development increased their knowledge and two others stated that professional development increased their motivation and confidence, and gave them a relative advantage (Rogers, 2003). Participant 4 said: "It increases awareness of new methods of learning and classroom pedagogies and I have learnt new ways of researching and how to organise files digitally." Participant 2 said, "It increases

confidence to try new pedagogies" and Participant 1 said, "It increases motivation, it is very positive". Most of the responses gained from this relate to teachers' motivation and engagement with continuing to learn about ICTs. This links to a teacher's attitude and perception towards ICTs and is discussed in the next section.

Third, teachers were asked which type of ICT professional development had the biggest impact on their teaching practice. Interestingly, and perhaps not surprisingly, responses varied greatly because there are many different professional development options available for teachers in the area of ICTs. The responses included:

- use of specialist software on the iPad
- literacy and research skills
- online resources such as content management systems
- the use of technical and operating software skills
- the use of data projectors and smart boards
- online resources such as TED talks for inspiration.

In contrast to this, teachers were asked which professional development on ICTs had the least impact on their teaching practice. Participants' responses were based on features of professional development rather than a distinct type of professional development. The most frequent responses included: professional development that was removed from a real-world context that was lacking in practical examples and that was poorly delivered.

Analysis of features of professional development and the conceptual frameworks

These findings highlight the relevance of the two conceptual frameworks and how these frameworks can be used as a matrix for analysis and interpretation of the results. In relation to Tearle's *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004) the three factors to be considered include:

- The whole-school characteristics
- The ICT implementation process
- Individuals.

The analysis showed that the participants felt that much of the professional development offered used *a one size fits all approach* and that teachers were unable to

obtain individualised support. Tearle's framework discusses the importance of having a collaboratively developed culture and this could be applied to the professional development that is offered within a school. Tearle also discusses the practical and material resources that are required to manage the ICT implementation process and while teachers feel that technical support structures are in place, an opportunity exists to utilise technical support staff in the area of professional development, hence more resources may need to be allocated in this area. Tearle also discusses the importance of a teachers attitude towards the professional development and what impact this will have on their practice. If the features of effective professional development are considered, a teachers' attitude towards the professional development will be enhanced. This analysis is supported by the theory relevant to the second conceptual framework *Diffusions of Innovations* (Rogers, 2003). Rogers' lists the importance of relative advantage, compatibility and trialability to ensure teachers' engage with learnings from professional development. Participants listed these features as crucial to their preferred method of professional development.

Analysis of teachers' attitudes and perceptions towards ICTs

A teacher's attitude and perception directly affects the likelihood of any transformation in a teacher's ICT practice (Gilbert, 2007). In this section, teachers were asked what motivated them to attend professional development on ICTs, whether they intended to continue learning about ICTs, and where ICT professional development was placed in relation to other professional development priorities. In relation to the first question, participants responded with a wide variety of responses. These were the most frequent responses: four teachers mentioned that the benefits for students inspire them to improve their use of ICTs; three said that they were motivated because they had a personal interest in ICTs; and three said that ICTs make them more efficient and effective.

Although four teachers reported that ICT can benefit students, previous research has not been able to clearly identify any direct benefits, largely due to the complexity of measuring any direct link between ICT practices and students' learning outcomes (Erstad, 2009, p. 21; Starkey, 2010, p. 3). This may be largely because it is the quality of teaching and learning that has the biggest impact on a student's outcomes rather than a technological device or computer software (Hattie, 2009). However, research has also identified that there are benefits for students in the area of increased

collaboration and engagement of students in learning (MacDonald, 2008; Pollard & Pollard, 2008; Starkey, 2011).

All six participants stated that the use of ICTs in their practice was critical and their motivation to continue learning was important. Five teachers said that it was a high priority as long as it was relevant, which is heavily linked to the concept of relative advantage (Rogers, 2003), but only one stated that it was their highest priority. One teacher said it was a lower priority after leadership and curriculum. Given that the majority of participants identified professional development on ICTs as one of their top priorities, this links to the theme *Changing and evolving use of ICTs,* which is discussed in Chapter 6.

Analysis of challenges or barriers preventing change to ICT practices

The problem of conflicting priorities appears to be one of the main challenges or barriers that prevents teachers from implementing the outcomes learnt in any professional development course on ICTs (Drent & Meelissen, 2008; Fullan, 2002; Petras, 2010). Importantly, this was clearly identified as a main barrier in this current research. There are, nonetheless, a number of other challenges or barriers that exist, and therefore, participating teachers were asked open-ended questions in relation to the barriers they have experienced. The most frequent challenge or barrier mentioned was inadequate follow-up and support. Professional development planners need, therefore, to recognise that in order for a change in ICT practices to be implemented in the classroom, there must be an ongoing cycle that includes the established four stages: learn, reflect, practice and refine. Once the initial learning experience has taken place, reflection is critical because it allows the teacher to contextualise what they have learnt to be suitable for their particular classroom or students. For the practice and refine stages, follow-up and support is critical (Mayer & Lloyd, 2011). As teachers trial new practices, processes may need to be clarified and teachers given the opportunity to question and seek further guidance. If professional development does not provide this avenue, its impact is minimised. The validity of offering any professional development without follow-up or support is questionable.

5.5.3 Analysis of the term *Impact*

Initially it was intended that this research may provide a list of impacts that would demonstrate how teachers' ICT practices have changed as a result of attending

or participating in professional development. However, the research revealed that the impacts are largely of an intangible nature and are based around a teacher's attitude, perceptions, knowledge, beliefs, values, skills, motivation and confidence. These intangible impacts are not stationary, they continue to evolve as teachers develop, learn and reflect on their own learning. Given the nature of such intangible impacts they are clearly difficult to measure and the instruments designed for this research were not initially constructed with this purpose. Hence, upon my own reflection further insight in this area would have resulted in a modification or addition to the instruments in an attempt to gather additional data on the intangible impacts of a change in teachers' ICT practices. This is further discussed in section 7.5 Limitation of the research and conclusions.

5.5.4 Summary

In summary, this section has analysed the impact that professional development had on experienced teachers' ICT practices at this site and the following conclusions have been made. All participants were positive about their attitudes and beliefs with ICTs, were engaged with professional development opportunities that were available, and with follow-up, support and practice, they would be able to utilise their new skills in the classroom.

Many problems based on organisational support and change prevent further impact from occurring in the classroom: for example, a lack of encouragement via the whole-school culture of learning about ICTs; conflicting priorities and low priority assigned to ICTs; and infrastructure and technical support issues. As well as these factors is the inability to accurately measure benefits for students, which results in some teachers questioning the relative advantage for them to adopt innovations in ICT practices (Guskey, 2005; Rogers, 2003). Given these many problems and teacher's perceptions of relative advantage, this supports the ongoing theme of *Upward management and skilling of school leaders*, which is further discussed in Chapter 6. This concludes the analysis of the second research question. The next chapter provides further discussion on the recurring themes that have been identified using the thematic analysis process.

Chapter 6 Discussion of Themes

The research methodology outlined in Chapter 3 was based on thematic analysis techniques and is being used as a framework for this research to discuss the findings. According to Braun and Clarke (2006), "Thematic analysis is a method for identifying, analysing, and reporting patterns within data" (p. 6) and focuses on the content, the patterns and the relationship between the patterns or themes. A theme is defined as "something important about the data in relation to the research question and represents some level of patterned response or meaning with the data set" (Braun & Clarke, 2006, p. 82). Chabi (2011) notes that thematic analysis is much more than a simple identification of themes: it is how these themes are structured and linked together.

The discussion in this chapter identifies the five themes and the links between the themes. This discussion is presented in textual and visual form and can be used as a guide by leaders in this school to implement a change-managed professional development process to develop teachers' ICT practices. The themes include ICT practices and professional development, but also address the impact of whole-school culture on any process of reform. This chapter discusses what the themes mean, how valuable they are, why they are important, and identifies the links and patterns between the themes.

6.1 The five-theme model

This section lists and presents the five themes in a model. The purpose of the model is to show how the themes are linked together. Following this, each theme is discussed in more detail.

The five themes that have been identified from the results and analysis are:

1. Primary use of ICTs outside the classroom
2. Changing and evolving use of ICTs
3. Upward management and skilling of school leaders
4. Changing and evolving professional development for ICTs
5. Promoting the value of alternative types of professional development.

The model (Figure 6.1) shows the five themes (numbered 1 to 5), as well as the links between the themes. The themes were identified due to the frequency with which they were mentioned or their impact or significance to the research questions that guided the study. The links were identified due to the relationship with each other and with the research questions.

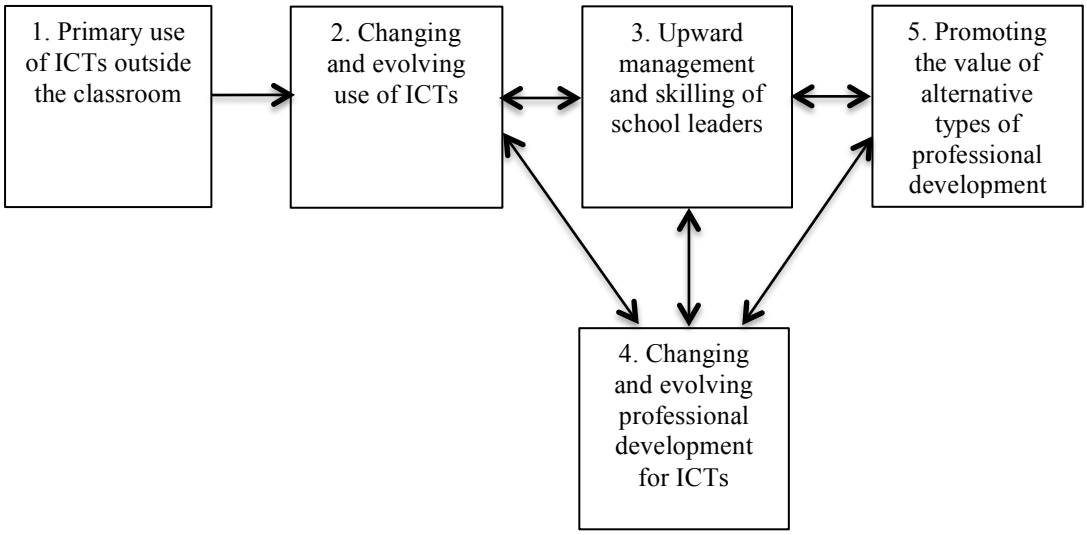


Figure 6.1 The five-theme model

6.1.1 Identifying the links between the themes

In this section, a brief discussion of the links between the themes is highlighted. Following this, each theme is discussed in more detail.

- Themes 1 and 2 relate to the first research question: What are experienced teachers' perceptions of their current ICT practices? Theme 1 is a snapshot of experienced teachers' perceptions of their current ICT use. Theme 2 identifies that while teachers may currently use ICTs in this manner, this is subject to constant change due to the rapid development of technology both in society and in education. The constant cycle of change in technology has an impact, not only on individual teachers, but also on school leaders and professional development methods.
- Theme 3 represents the theme of upward managing and upward skilling the school's leaders and links themes 1 and 2 and themes 4 and 5. Theme 3 refers to the importance of school leaders and school culture to inform change and bring about ICT innovation in teachers' practices. This theme

highlights the need for school leaders to be aware of innovation in ICT practices, as well as innovations in professional development methods or those professional development methods that have a positive impact on teachers' ICT practices.

- Themes 4 and 5 relate to the second research question: What impact has professional development had on experienced teachers' ICT practices? These themes are linked to each other because they focus on types of professional development and the fact that there are a variety of alternative professional development methods that are being used by teachers to develop their ICT practices.

6.1.2 Reference to conceptual frameworks

Two conceptual frameworks were chosen to provide an underlying theoretical foundation to use as a basis for interpretation, analysis and discussion of this research. The five themes reference several parts of these frameworks. For example Theme 3 – Upward management and skilling of school leaders draws on the theory of whole school ICT implementation processes which forms part of Tearle's *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004). The second conceptual framework is *Diffusions of Innovations* (Rogers, 2003), which provides a theoretical foundation specifically for Theme 4 - Changing and evolving professional development for ICTs. Specific mention of these frameworks is referenced during the discussion of each theme.

In the next five sections, the research findings are used to support the identification of these themes, followed by discussion on the significance of these issues for school leaders, teachers and professional development programs.

6.2 The five themes

Based on the results and analysis in the previous two chapters, five themes became clear due to the frequency with which they were mentioned or their impact or significance to the research questions:

1. What are experienced teachers' perceptions of their current ICT practices?
2. What impact has professional development had on experienced teachers' ICT practices?

The five themes and explanations are provided below, followed by a model showing the links.

1. **Primary use of ICTs outside the classroom.** This relates to the first research question, which identifies how experienced teachers are currently using ICTs. While a variety of uses have been identified, it is evident that the majority of those occur outside the classroom for planning, creating resources and reporting.

2. **Changing and evolving use of ICTs.** Change and improvement processes were dominant throughout the research. Change is fundamental to ICTs in society and education. Experienced teachers constantly have to adapt to new hardware and software, and the pace of change is frenetic. This pace of change results in change-weariness and can be an obstacle in any improvement agenda.

3. **Upward management and skilling of school leaders.** This theme became evident because the research shows the importance of leadership and whole-school learning culture in any change process or professional development program. This theme was pivotal in that it linked together the two research questions, referenced Diffusion of Innovations theory (Rogers, 2003) and *A theoretical and instrumental framework for implementing change in ICT in education* (Tearle, 2004), involved whole-school ICT culture and provided a framework to further contribute to the professional development of teachers. Schools often rank ICT use and professional development of ICTs as a lower priority for a variety of reasons. It is suggested that teachers and Heads of Department can drive ICT innovation and influence, by upward managing and upskilling this study site's school's leadership team. This finding is confirmed in previous research, which argues that teachers need to upward manage, or upward skill, the leaders in the school (Darling-Hammond & Richardson, 2009; Drent & Meelissen, 2008; Fullan, 2002; Gilbert, 2011; Rogers, 2003; Wachira & Keengwe, 2011) (previously analysed in Section 5.4.2).

4. **Changing and evolving professional development for ICTs**. For a professional development program on ICTs to be effective, it must be contextual, provide a relative advantage and allow for practice and

trialability. Professional development must also adapt to changing schools and evolving ICT practices to have a positive impact. This theme is discussed in this chapter in the context of ICT practices.

5. **Promoting the value of alternative types of professional development.** New methods of professional development of ICTs have been identified due to a number of reasons, including conflicting priorities; teachers' own personal beliefs; and teachers' willingness to learn from family and friends. These methods have had a positive impact on teachers' practices; therefore, it is recommended that they be promoted within this school.

In the following five sections, each theme is discussed in relation to the research findings, references to literature and how the themes are linked.

6.2.1 Theme 1: Primary use of ICTs outside the classroom

The first theme identified from the results and analysis links to the first research question: What are experienced teachers' perceptions of their current ICT practices? The findings show that the majority of ICT use is occurring outside the classroom. These results were found in several areas of the data. For survey data (see Section 5.4.1), for interview data (see Section 5.4.2) and for the analysis of teaching standards and focus areas (see Section titled Analysis of focus areas). These results are represented visually in Figure 6.2.

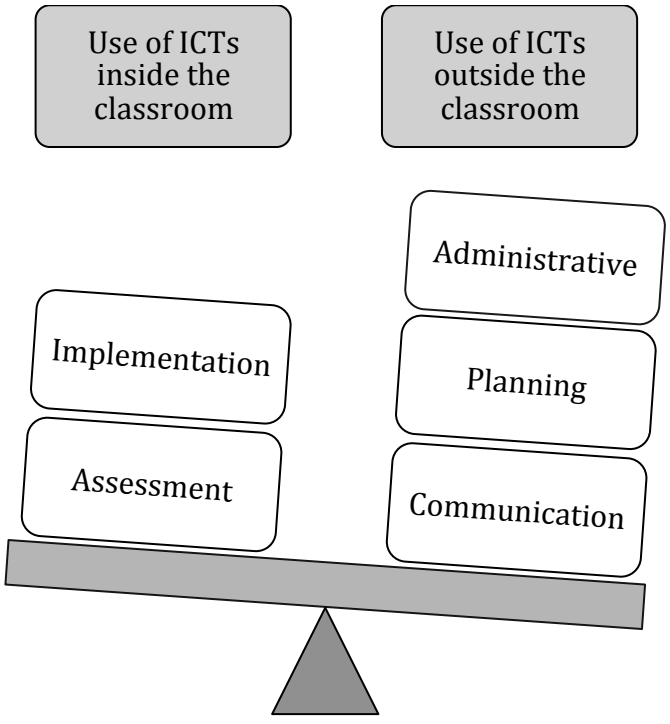


Figure 6.2 Primary use of ICTs outside the classroom

These findings are supported by previous research. Cuban (2001) argued that curriculum and teaching practices were not transforming and technology was not being used to its full potential; Dunn and Rakes (2010) suggested that this was still the case a decade later. Sipila (2012) argued that schools' and teachers' pace of change is slow. Others argue that ICT practices in classrooms are slow to evolve due to the difficulties associated with measuring the effectiveness of ICTs (Hixon & Buckenmeyer, 2009; Scheuemann & Pedro, 2009; Webb & Cox, 2004).

Current use of ICT practices in the classroom

The effective implementation of ICT practices in the classroom to enhance students' learning lags behind the use of ICT as a tool to help teachers carry out their general duties, such as administration, planning or communication duties.

When ICTs were being used within the classroom, it was mainly for the dissemination of information, through the presentation of multimedia or textual information, or for inquiry or research. Importantly, no participants discussed the use of ICTs for critical or creative thinking, or in other words, higher order thinking.

Why teachers need to learn more use of ICT practices in the classroom

Society demands that students have enhanced technological skills, and research has shown that their acquired skills through social networking and internet use is primarily as a receiver of information (BECTA, 2008, p. 12; Scheuermann & Pedro, 2009, p. 19). ICT practices can be used within the classroom to enhance and accelerate students' learning. ICT practices can increase student engagement and can also be used as a tool to encourage the development of students' thinking skills, such as creative and critical thinking, analysing, synthesising and evaluating. However, quality teachers, both experienced and inexperienced, need to learn the knowledge and skills to effectively embed the use of ICTs in quality pedagogical practices. This will ensure that students are thoroughly prepared for future careers and life in a technologically driven world as society demands.

Links to other themes

This theme links to the theme of the *Changing and evolving use of ICTs* as well as the two themes based on professional development models. As ICTs continue to change, it is also clear that continued research into how ICTs influence teachers'

practice and students' learning will remain a central concern for those leading the professional development of teachers. Given these changes, it is essential that teachers' knowledge and skills be developed through well-designed programs of professional development. Poorly designed or implemented professional development that has little or no impact on teachers' practices is a waste of valuable resources.

6.2.2 Theme 2: Changing and evolving use of ICTs

The second theme refers to the cycle of change associated with the use of ICTs in society and in education. The findings show that all six participants frequently stressed that there was a constant cycle of change related to ICT practices and that there was pressure on them to adapt and refine their use. They all commented that they felt it was expected and necessary to change and evolve their ICT practices. All six teachers stated that they were motivated to change and develop, and that innovations such as iPads and BYOD were sources of inspiration. Other frequently mentioned reasons to change included a personal interest in ICTs, that ICTs result in an improvement in effectiveness and efficiency, a belief that ICTs are necessary for future careers for students and a belief that ICTs increase students' engagement. Several teachers mentioned obstacles that decreased their motivation to change their ICT practices and these included other school priorities, such as NAPLAN and a lack of time to fully engage in professional development and to trial and test new ICTs in the classroom.

The impact of changing ICTs

The changing nature of ICTs in schools impacts not only individual teachers, but also the whole-school culture of ICTs and school-wide processes, including significant changes in infrastructure (e.g. increased devices in schools and BYOD). Even after the Australian Government injected $2.4 billion into the Australian education system (DEEWR, 2008), all six participants commented that they needed more access to devices. Five of the six participants felt that BYOD was a positive agenda and encouraged this in senior classes because they felt BYOD enhanced flexibility, self-paced learning, inquiry and access to online resources. The same teachers, however, were actively discouraging BYOD uses in junior classes due to online safety concerns as well as disruptions to classroom learning. In relation to technical support within the school, five teachers stated that technical support structures were in place and that the

technicians were invaluable; nevertheless, these support staff are generally overwhelmed due to the size of the school and the number of technical problems.

Why whole school ICT change is necessary

With this changing infrastructure and technical requirements in schools, teachers and school leaders are now experiencing new obstacles that prevent them from implementing ICT practices. These obstacles are diverse and include whole-school issues as well as technical issues. All six participants listed competing priorities within a school (e.g. NAPLAN and attaining academic benchmarks), as well as inadequate follow-up and support after professional development as the main obstacles they were currently faced with. To overcome these obstacles and strategically improve the uses of ICT practices, the findings support two frameworks from previous research that outline how best to manage ICT change in schools.

Rogers' (2003) Diffusion of Innovations framework specifically focuses on the change-management process of innovations, such as ICT practices, and how this can be developed in teachers. The findings from this research highlight the need to focus on promoting the Attributes of Innovations to motivate teachers to adopt changes, in particular, the relative advantage, simplicity and ease of use, and trialability of ICT practices. Refer Chapter 5 (Section titled Rogers' Diffusion of Innovations: Attributes of Innovations).

In addition to Rogers' (2003) theory, Tearle's *A theoretical and instrumental framework for implementing change in ICT in education* (2004), provides a model for the factors to consider when implementing ICT changes and lists whole-school characteristics; the ICT implementation process and individuals as the three keys factors. The findings from this particular study site highlighted that there were issues relating to the whole-school characteristics as well as the ICT implementation processes including inadequate funding, lack of leadership, inequitable access to technology and slow resolution of technical issues as the main issues. If the overall goal is to increase the use of ICT practices by experienced teachers within the classroom, school leaders must be innovative and creative in designing solutions to improve the ICT learning culture and technical platform from which teachers can reform and improve their use of ICT practices.

Links to other themes

This theme has many links to the other remaining themes. Change underpins ICT practices and professional development, and given that ICT practices are constantly changing and evolving, whole-school leadership (Theme 3) and professional development programs (Theme 4) must also adapt and change. For example, to change experienced teachers' ICT practices, the focus of professional development and the type of professional development needs to evolve to include small-group, hands-on, differentiated methods based on quality teaching and learning practices with embedded ICTs. Consideration of Rogers' Attributes of Innovations framework (2003) in particular, concepts of relative advantage, simplicity of use and trialability, must be incorporated in the design and implementation stages of professional development, as evidenced by the research findings.

6.2.3 Theme 3: Upward management and skilling of school leaders

This theme has been identified as crucial because it links the other two sets of themes together. Themes 1 and 2 relate specifically to experienced teachers' ICT practices and the changing nature of ICT in schools. Themes 4 and 5 discuss issues related to changing professional development models in line with ICT changes and promoting the value of alternative professional development models. Theme 3 links these two sets of themes by analysing the role that the school leaders play in this change-management process through the implementation of professional development that has a positive impact on teachers' ICT practices. Theme 3 is discussed in the next section. This is supported by evidence provided in Section 5.5.1 Learning from direct supervisor.

The impact of school leaders on ICT practices

The findings showed that all six participants believed that the leadership and senior management of the school promoted the use of ICT implementation. However, half identified that school leaders' understanding of ICTs was also evolving, and therefore, the leaders may not be cognizant of current ICT practices, challenges or successes. One participant said:

> A number of leaders may not fully understand digital pedagogies due to their own use of ICTs in the classroom when they were still teaching. If school

> leaders are not regularly visiting classrooms, they may not be aware of some of the ICT practices that teachers are embedding into their classroom.

The findings from the survey on the professional development methods with the least impact were directly related to the influence of school leaders, which included domain meetings (faculty meetings) and learning from your direct supervisor (e.g. Head of Department or Deputy Principal). This relationship between the school's leaders and the impact they have on the professional development confirms the link between themes.

All participants highlighted the need for teachers to upward manage or upward skill the leaders in the school. These findings are supported in research (Darling-Hammond & Richardson, 2009; Drent & Meelissen, 2008; Fullan, 2002; Gilbert, 2011; Rogers, 2003; Wachira & Keengwe, 2011).

Five of the six participants referred to the trial and error processes as part of the process of adopting ICT practices. Trialability is an essential component to encourage teachers' motivation to continue to learn and to build confidence and ability. (Rogers, 2003). Five of the six teachers said they were able to experiment with ICT practices in both senior and junior classes. This also links to Tearle's *A theoretical and instrumental framework for implementing change in ICT in education* (2004). In particular, developing whole-school characteristics such as ICT culture, which suggests that if the school's leaders were to encourage innovation and risk taking in the area of ICT practices, teachers would be more likely to evolve in the use of ICT practices. The onus here is on the school leaders to ensure that teachers feel encouraged to try new methods and reflect on their success without any detriment to students' learning.

Plan for upward management and skilling of school leaders

The findings from this research show that teachers who are best positioned to take on the role of *upward managing and skilling the schools' leaders* are those classified under Rogers' (2003) Diffusion of Innovations theory as *early adopters* or *early majority*. From the six participants interviewed, five identified themselves as an innovator, early adopter or early majority and described that they had the level of confidence and technical ability required to influence school leaders in order to reshape the whole-school culture.

Schools must have a comprehensive plan focused on upward management and skilling of school leaders in classroom-based ICT practices, with the outcome of influencing the leaders to subsequently promote and encourage the use of ICTs, thereby influencing other teachers to adopt innovations. This recommendation is represented in Figure 6.3 in the context of Rogers' (2003) Diffusion of Innovations theory.

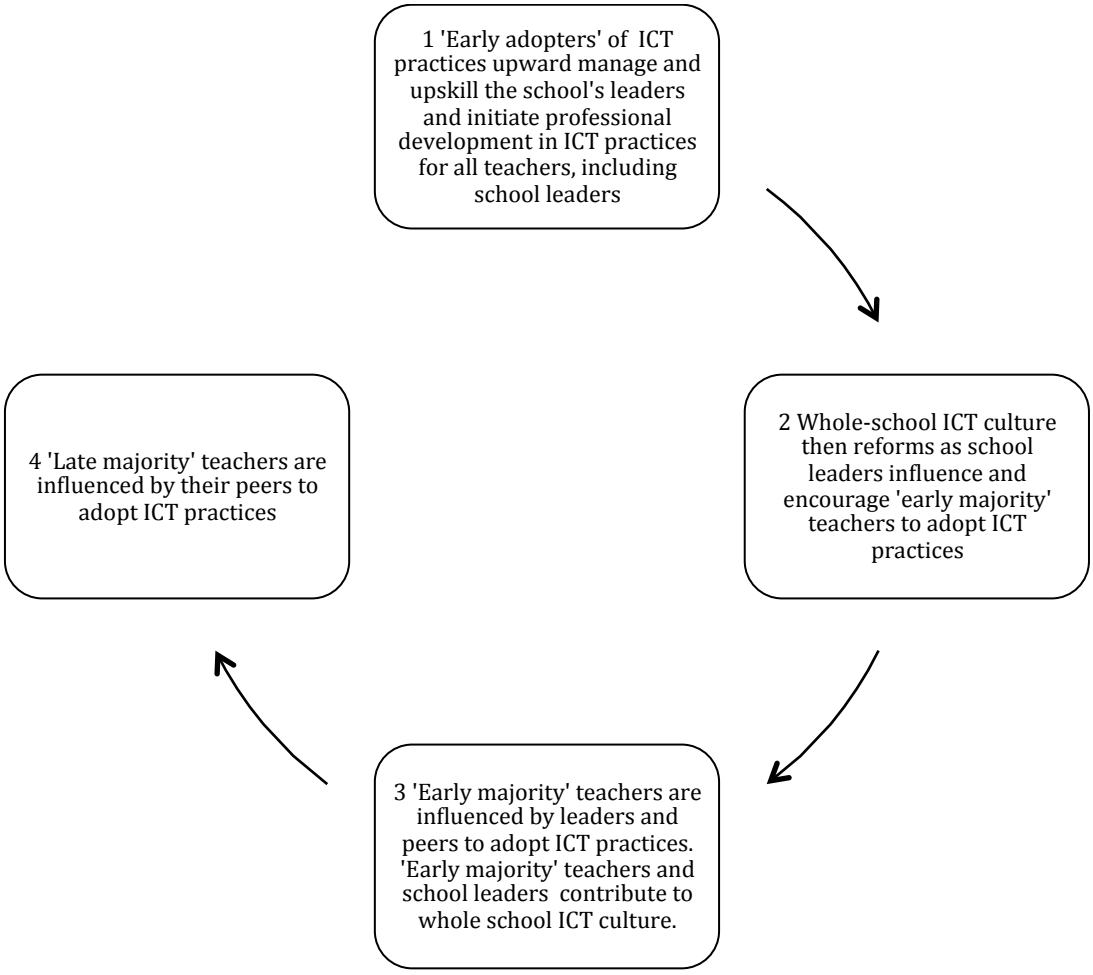


Figure 6.3 Upward management and skilling of school leaders

Links to other themes

If school leaders are lacking in their knowledge and confidence in using ICT practices, this may impact on the whole-school culture of ICT learning. School leaders' ICT practices links with the first two themes of current ICT practices (Theme 1) and changing ICT practices (Theme 2). School leaders must be at the forefront of innovations in pedagogies, but given that they are not always in the classroom, in the case of Principals and Deputy Principals, they do not have the opportunity to trial new ICT practices, and therefore, their confidence in using these practices may decline.

Rogers (2003) argues that trialability is essential in any adoption of an innovation. The challenge, then, is for school leaders to grow this confidence through observation or other means.

In the next two sections, Themes 4 and 5 are discussed. Both of these themes relate to the second research question: What impact has professional development had on experienced teachers' ICT practices?

6.2.4 Theme 4: Changing and evolving professional development for ICTs

Theme 4, identified in this section, discusses the change and evolution of professional development models, particularly in relation to learning ICT practices. Theme 4 is linked to Theme 2 via the concept of change. As ICT practices change and evolve (Theme 2), the professional development required to learn about these ICT practices also needs to change and evolve in order to have the highest impact on teachers' ICT practices.

Professional development with the highest impact

The findings from this research show that these experienced teachers engaged in a variety of methods to learn about ICT practices:

- self-paced online learning
- learning from family and friends
- learning from students
- observing their peers
- learning from school technicians.

The findings also identified key features that are common to the preferred professional development methods:

- self-paced
- small group
- hands-on
- contextual
- includes follow-up and ongoing support.

Why the format of professional development needs to change

The findings from the research are significant and point to the importance of schools ensuring that their resources, including financial, human resources and time, are maximised. It is suggested here that professional development should be *differentiated* for teachers, so that they can identify the *relative advantage* for their classroom and can adapt the practice to their own *context*. It is also suggested that any model of professional development in relation to ICT include *follow-up and support* so that teachers can *reflect*, *practice* and *refine* what they have *learnt*. The processes of reflecting, practising and refining include the concept of *trialability* (Rogers, 2003) and refers to the degree to which teachers are able to experiment with the use of ICT practice in classrooms without any negative impact. This model of professional development needs to evolve, along with the school's culture, which must support, encourage and prioritise ICT innovation. The evolution and reform of school culture in relation to alternative methods of professional development is the topic of the final theme (discussed in Section 6.2.5).

Why the content of professional development needs to change

The other key element to this theme is that the content of professional development in relation to ICTs needs to evolve. Professional development must be differentiated for individual teachers and it needs to evolve to include the use of ICT practices within the classroom, specifically to encourage students' higher order thinking. At present, the use of ICTs by experienced teachers is based outside of the class for administration, planning and communication (refer to Theme 1). Professional development programs specifically targeting the use of ICT practices inside the classroom must be investigated, identified, implemented and made a priority. This involves influencing school leaders (refer to Theme 3) to ensure that this is prioritised within any professional development program and as part of the whole-school vision and culture of learning.

6.2.5 Theme 5: Promoting the value of alternative types of professional development

This final theme is linked to previous themes and is a major part of reforming whole-school ICT learning culture. Professional development aims to change or improve a teacher's knowledge or practices. While many professional development programs have been used since ICTs started appearing in schools in the 1980s,

professional development models are still largely designed and implemented based on traditional methods. This is primarily due to limitations of financial and human resources, and minimising teachers' absences from classes. However, previous research has shown that there has been little change to pedagogical practice in two decades and that teachers change their ICT practices somewhat slowly (Dunn & Rakes, 2010; Jamieson-Proctor & Finger, 2010; Sipila, 2012).

Alternative methods of professional development

The findings from this research show that experienced teachers are accessing alternative forms of professional development regularly in their own environments and that these alternative methods of professional development are having a positive impact on changing teachers' ICT practices. The types of professional development with the highest impact are:

- structured online courses
- self-taught trial and error
- personal use at home
- learning from family and friends.

Why alternative methods of professional development should be valued

Given that ICT practices are evolving rapidly and that this research has shown that teachers regularly use professional development in their own personal time, whole-school ICT processes and professional development culture must reform to reflect these changes. The findings from this research point to the success of alternative methods of professional development and these must be recognised and promoted to all teachers. The selection and coordination of structured online courses for specific members of staff, differentiated to their specific needs, must be planned and encouraged. Teachers who undertake professional development in ICTs in their own time should have this personal learning acknowledged and recognised. Learning through formal observation of another teacher's practice should be continued and supported. School technicians should also play a pivotal role in upskilling teachers' ICT practices and their contribution should be planned and encouraged.

Links to other themes

These suggestions may inform a cultural change in the workplace in relation to school leaders' approaches to professional development (Theme 3, Theme 4) and to

teachers' motivations and acceptance of the need to constantly evolve their use of ICTs (Theme 2).

6.3 Summary

The data from this research project confirms that the evolution of ICTs in classrooms is shaped by the learning culture of an organisation, and in particular, the leadership of the organisation. The diagram of the five themes (Figure 6.4) shows how the development of experienced teachers' ICT practices and the types of professional development accessed within a school are linked and how important the school leaders' roles are to any changes in ICT practices.

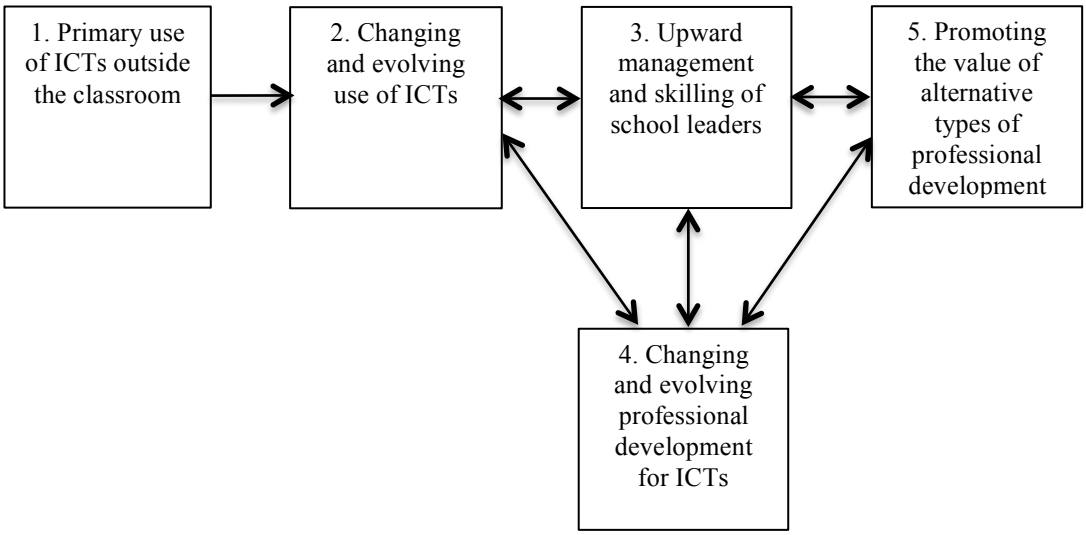


Figure 6.4 The five-theme model

The findings from the research show how evolving ICT practices do not always come naturally to experienced staff and that this is due to a range of other priorities, a lack of knowledge and confidence, and technical and other barriers. However, the experienced teachers interviewed in this research showed they were motivated to transform and change their practices if they saw direct benefits for students, if it gave them a relative advantage, if it was compatible with teachers' own values and beliefs about education and if it was relatively simple to implement and use. The findings point to these teachers' motivations stemming from the fact that they found ICT practices interesting, relevant, efficient and of benefit to students' learning and engagement.

Based on the study at this site and its findings, there are several challenges for this school in terms of increasing the use of ICTs within classrooms.

- First, the role and challenge for teachers in this school is to recognise that they can guide and shape changes to ICT practices within a school. They must embrace technological change and ICT innovation within the context of effective pedagogical practice. Teachers who are at this level of engagement, motivation and confidence must take on a leadership role within the whole school in order to change the culture of learning. This will not only influence peers but school leaders, which is necessary to make any whole-school ICT culture change.
- Second, school leaders at this site, must reflect on the placement of ICTs within whole of school priorities and ensure that any change agenda for ICTs offers teachers a relative advantage. School leaders must carefully design, plan and differentiate teachers professional development programs in ICTs and ensure it is embedded within quality teaching and learning practices and also promote the use of alternative methods of professional development for learning ICTs, particularly those that have a high impact on changing teachers' ICT practices.

The next chapter outlines a brief summary of the research, conclusions that have been made, the study's limitations, and recommendations and practical suggestions for future research in this area.

Chapter 7 Conclusions

This chapter contains a brief summary of the research and conclusions based on the results, analysis and discussion of the themes. In addition, the limitations of the research and practical suggestions for implementing the recommendations are outlined. The final section includes some suggestions for future research.

7.1 Purpose of the research

The overall aims of this school-based case study were to increase the understanding of how experienced teachers' ICT practices, within one Queensland state high school, have changed as a result of professional development activities. It was anticipated that an increased understanding of the link between professional development and the impact that it has on teachers' practice would provide a roadmap for supporting teachers within this school as they contend with an ongoing agenda of change.

This research specifically examines two questions:

1. **What are experienced teachers' perceptions of their current ICT practices?** This includes a self-reported identification of how ICTs are used by teachers to implement effective teaching and learning environments, which incorporates communication, administration, planning, implementation and assessment practices.
2. **What impact has professional development had on experienced teachers' ICT practices?** This includes an analysis of the different types of professional development, the teachers' attitudes and perceptions towards the professional development and the impact the professional development had on experienced teachers' ICT practices.

The intended practical outcome of this research was to provide a model of professional development that would have a positive impact on experienced teachers' ICT practices, based on reforming whole-school ICT culture and professional development models. To provide this model, the current use of ICT practices by experienced teachers must be understood, including a thorough understanding of how experienced teachers are engaging in professional development and what impact it is having on their ICT practices.

This research is significant given that teachers are increasingly expected to work in digital environments due to the ever evolving and changing nature of technology in classrooms. With recent federal and state government initiatives that have injected in excess of $2.4 billion dollars nationally, and with the increasingly popular BYOD policies, technology-rich classrooms are the normal classroom environments. If schools and teachers are not able to embed this technology into the learning process to improve students' outcomes, then any investment made by governments and parents has uncertain benefit and the community would question how and whether our students are being adequately prepared to work and live in technological societies.

7.2 Summary of the research project

This research project began with a background outlining the change agenda happening in schools in relation to ICT practices and how ICT innovations in society flow into the classroom. Teachers are constantly required to adapt through policy innovations, but receive limited professional development in this area. The purpose of the study was to increase an understanding of experienced teachers' current ICT practices and the impact of various professional development methods within one Queensland state high school.

In a number of countries, including the UK and the US, ICTs were first introduced into educational institutions in the 1960s. As a result of these changes in schools, policy makers began drafting educational policies to incorporate these new technologies, and teachers were experiencing many impacts. Some teachers were, and remain, resistant to change agendas related to technological innovations. Since the 1990s, much research has taken place to determine the effectiveness of technology in improving student outcomes; however, ICT and its direct impact on student outcomes is a very contentious body of research with no clear answers. Technology is not an optional addition to a teacher's toolbox; instead, teachers are now required to use ICTs in a variety of ways to know their students, to plan and implement curriculum, to assess and report, and to communicate with peers, students and parents.

To support teachers through this change agenda, school leadership teams must design and implement an effective model of professional development. In this study,

features of effective professional development were identified, as were the common barriers and obstacles that these teachers experienced in their attempt to improve their ICT practices. Teachers' attitudes and perceptions play a significant role in ensuring their willingness and motivation to engage with any ICT change agenda. The attitude and perceptions of school leaders also plays a significant role in the adoption of ICT practices by teachers due to their impact on whole-school ICT culture.

7.2.1 Summary of research specific to this study site

The research methodology outlined in this section was designed as a qualitative case study because the specific purpose of the research was to understand changes in experienced teachers' ICT practices at this site as a direct result of the implementation of ICT professional development methods. The case study methodology included the collection of data from teachers at the study site through a survey and interviews, as well as the examination of a national policy statement in relation to these teachers' ICT practices.

The survey was conducted online and more than 40 teachers were invited to participate. Sixteen experienced teachers, who met the eligibility criteria, completed the survey in relation to their ICT practices. This survey focused on teacher practices specifically mentioned in the Australian Professional Standards for Teachers policy (see Appendix A: Survey). From the survey respondents, six participants volunteered to be interviewed about the impact that professional development had on their ICT practices. The interviews were designed to give the teachers the opportunity to reflect and to elicit responses on how and why their practices have changed. The interview included questions about how they worked in a digital environment, how they engaged with professional development, how they enabled learners to utilise ICTs and the impact that changing infrastructure had on their ICT practices (see Appendix B: Interview).

Based on the data, results were presented and analysed, and thematic analysis techniques were applied to identify patterns and relationships between ICT practices and professional development. Five themes were identified and discussed in the context of this particular school site. The results, analysis and discussion of themes could be used as a guide for this site's school leaders, who may be planning to

implement a change-managed professional development process to develop experienced teachers' ICT practices. The themes include ICT practices and professional development, but also address the impact of whole-school culture on any process of reform. The following section presents the primary findings from the research project.

Conducting this research at my workplace resulted in a number of issues as well as providing opportunities for staff involved. Firstly, securing staff who were willing to be involved was likely swayed by existing relationships and my long standing reputation as an ICT leader in the school. In hindsight, I would have preferred to interview teachers who were unknown to gain a variety of perspectives. Secondly, there was a tendency for some of the participants to talk very freely and openly about their criticisms of the school and its operations, again due to their familiarity with myself. This issue was dealt with by ensuring an ethical approach to data collection was upheld. The strengths or opportunities from this research have been ongoing. In my current position based on the research and my leadership, I now strategically lead professional development programs across the school. Given this is founded on evidence-based research the credibility level is high and widely adopted as genuine improvement within change agendas.

7.3 Summary of Education Queensland Professional Development Policy

Teachers are constantly required to adapt to change relating to education policy, ICT innovations and curriculum change. During the course of this research there has been considerable change at a state level in relation to professional development policies.

The current policy is the Professional development framework (Education Queensland, 2012). The framework provides teachers with a process, documents and online tools to provide support and professional development, set career goals, provide coaching and feedback methods, review progress and recognise achievement. The developing performance framework was developed to align with the National Professional Standards for Teaching (AITSL 2011).

In addition to this, Smart Classrooms is a comprehensive strategy for digital education in Queensland schools. Due the nature of digital education, the strategy has undergone numerous variations, changes in terminology and introduction of new initiatives since it was first introduced over 10 years ago. Current support for teachers include a '*Contemporary Practice Resource'*, which includes strategies, teaching tips and digital tools written to support the implementation of the Australian Curriculum. The previously adopted *Digital Pedagogical Licence and Certificate* and *Student ICT Expectations* which were state-wide initiatives in the Smart Classroom Policy 2011-2014 (EQ, 2011) have now been removed from this current strategy. The Smart classrooms website currently listing its key initiatives as the Microsoft IT Academy, Digital Practice Guide (this is only for support staff), Websites for schools, National Secondary School Computer Fund, The Learning Place, Computers for Teachers and Contemporary Practice Resource. It is this last strategy as well as the Learning place that provides guidance and resources for teachers. However notable in its absence is a framework or policy relating specifically to the use of ICTs within a classroom.

7.4 Conclusions

In this section, general and specific conclusions are listed that relate to the teachers in the school site studied.

7.4.1 Overall conclusions

These general conclusions relate to the research question that focuses on how professional development impacts on experienced teachers' perceptions of their ICT practices.

- Teachers used ICT practices more outside the classroom than they did inside the classroom. This includes practices that may involve designing and creating curriculum, selecting resources, assessing student work and reporting on students' outcomes.
- Teachers believed that a moderate use of ICTs was crucial for teachers to perform their duties and responsibilities, but that ICT use did not replace other techniques, methods or strategies.
- Self-directed methods of professional development were more frequently accessed than other traditional methods. The most common were self-

taught trial and error, personal use at home, and learning from family and friends.

- Self-directed methods of professional development had more impact than other forms of professional development. The most common were structured online courses, followed by self-taught trial and error, personal use at home, and learning from family and friends. Meetings, learning from a direct supervisor, and social media had the least impact on teachers' ICT practices.
- Underutilised methods of professional development included formal observation of other teachers and peer mentoring from school technicians.

7.4.2 Conclusions specific to experienced teachers' perceptions of their current ICT practices

These specific conclusions provide more detailed information to support the overall conclusions just outlined and also provide a basis for understanding the recommendations in Section 7.6. These conclusions relate to Research Question 1 - What are experienced teachers' perceptions of their current ICT practices?

- The majority of ICT use by experienced teachers occurred outside the class through planning, lesson preparation, administration and reporting.
- Experienced teachers collectively perceived that ICT use was essential in a proportionate amount, but that ICT use did not replace, and could not be used as a substitute for, other techniques, methods or strategies.
- The most significant use of ICTs was when teachers were required to implement, design, use, select, create and report.
- All six participants were very motivated and engaged in ICTs and were very keen to ensure that their use of ICTs benefitted students.
- All six participants identified a variety of access issues that prevented them from regularly utilising ICTs in their classroom.
- When ICTs were used within a classroom, it was for the dissemination of information through the presentation of multimedia or textual information or for inquiry or research.
- Not one participant discussed the use of ICTs for teaching or engaging students in higher order thinking processes.

- The majority of participants felt that the whole-school culture and school-wide processes were encouraging ICT innovation and implementation. However, it was a lower priority in relation to other priorities, such as literacy and numeracy and tertiary entrance processes.

In summary, the use of ICTs by teachers within the site of this research was based on teacher practices undertaken outside the classroom, including administrative, communicative and planning practices. The teachers were motivated and engaged in learning about ICTs when there was a direct benefit for themselves or their students. Most of the ICT use within the classroom was based on disseminating information through multimedia methods or encouraging inquiry and research. It would appear that these teachers were not using ICTs within the classroom to encourage students in critical or creative thinking. A variety of challenges, including access and technical issues and new obstacles due to the evolving nature of ICTs, have prevented the use of ICTs within the classroom at this level. The teachers reported that the schools' leaders influenced how ICTs were used.

7.4.3 Conclusions specific to the impact professional development had on experienced teachers' ICT practices

These specific conclusions provide more detailed information to support the overall conclusions and provide a basis for understanding the recommendations in Section 7.6. These conclusions relate to Research Question 2 - What impact has professional development had on experienced teachers' ICT practices?

- The most frequently attended or accessed methods of professional development were based on a teacher's personal use or learning in a home environment.
- The types of professional development that were found to have the highest impact all occurred outside of the school environment. Some were facilitated by professionals, but others involved personal use or learning from family or friends.
- The data revealed several underutilised professional development types (those with low frequency of use but high impact), which included online courses, formal observation of others and learning from school technicians.

- The most successful or preferred characteristics of professional development training were being based on hands-on learning, having small groups, including practice time and demonstration, and using internal presenters.
- The impact that professional development had on teachers included an increase in knowledge, motivation and confidence.
- The impact in the classrooms was limited, however, because of changing obstacles or challenges due to the evolving nature of ICTs. This includes competing school priorities, the rapid pace of change and the role of school leaders.

In summary, professional development had an impact on these teachers in a positive way in relation to their knowledge, motivation and confidence. This impact mainly occurred due to self-directed learning through the personal use of ICTs or learning in a home environment, rather than through school-organised professional development programs. Several methods of professional development that had a high impact were underutilised in this school environment, including structured online courses, formal observation of other teachers' practices and learning from school technicians. Due to the evolving nature of ICTs, various new and existing obstacles prevented many of the teachers from making positive changes to their ICT practices, particularly within the classroom.

7.5 A model for professional development and reforming ICT practices

This research aimed to provide a model of professional development that would have a positive impact on experienced teachers' ICT practices. This model evolved after examining the data and the results, conducting analysis, and identifying themes and the relationships between these themes.

The final model (Figure 7.1) is based on the five-theme model (see Figure 6.1) and includes specific roles for teachers and for school leaders.

- The smaller light grey box, labelled *Role of teachers* refers to the themes specifically related to a teachers' role within the school and this includes theme 2 – 4.

- The larger dark grey box, labelled *Role of school leaders* refers to the themes specifically related to a school leaders' role within the school and this includes themes 2 – 5.

A discussion of the role for both teachers and school leaders in reforming ICT practices is offered after the figure in Section 7.5.1 and Section 7.5.2 which explains how the proposed model will work.

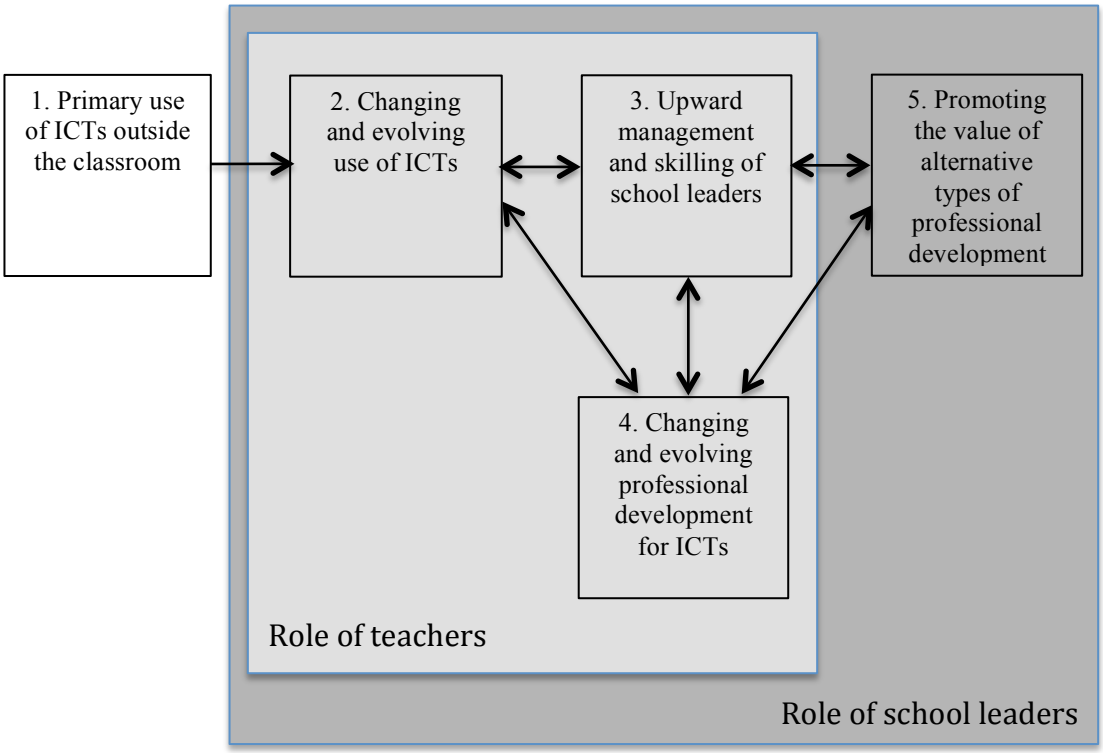


Figure 7.1 A model for professional development and reforming ICT practices

7.5.1 Role of teachers at this study site

The role and challenge for teachers, at this study site, is to recognise that they can guide and shape changes to ICT practices within the school. Experienced teachers must embrace technological change and ICT innovation within the context of effective pedagogical practice, not as a stand-alone or add-on concept. Teachers must move beyond administrative, communicative and planning uses of ICTs. ICT practices must be seamlessly integrated into the implementation of curriculum and assessment, and form part of quality teaching and learning. ICT practices must engage students in higher order learning, such as creative and critical thinking, it must engage students through collaboration and connections, and must enhance students' learning.

Teachers who are at this level of engagement, motivation and confidence must take on a leadership role within their school to change whole-school ICT culture and school-wide processes and reform the culture of professional development and the use of ICT practices inside the classroom. This will influence both peers and school leaders, which is necessary to make any whole-school ICT culture change.

Teachers must seek out methods of professional development, which can be through self-directed training at home with family and friends, trial and error, observation of peers, or learning from school technicians or students. Teachers must ensure that any professional development they access or attend follow these guidelines:

- offers them quality teaching and learning strategies, embedded with ICTs
- offers teachers a relative advantage (enhances teaching and learning)
- is contextual to their own situation (differentiated)
- is simple and easy to use
- allows for trial and error in the class
- includes thorough follow-up and support.

7.5.2 Role of school leaders at this study site

The role and challenge for school leaders, at this study site, is to recognise the importance of developing teachers' ICT practices within the classroom to encourage students with higher order thinking. School leaders must reflect on the placement of ICTs within whole-school priorities and ensure that any change agenda for ICTs offers teachers a relative advantage. School leaders must recognise that their values and their beliefs about ICTs shape the whole-school ICT culture and that they need to develop their own use and understanding of ICT practices within a classroom, particularly in the area of higher order thinking.

School leaders must recognise that they drive whole-school culture, and to enable change and reform in ICT practices, they must encourage trialability and innovation. This school's leaders must also be open to ideas from *early adopters* and *early majority* teachers who may present alternative ICT practices. Leaders must seek out the opportunity to promote changing ICT practices to other teachers. Leaders must be supportive when staff are testing ICT innovations and encourage others to do the same.

The school's leaders must carefully design, plan and differentiate teachers' professional development programs in ICTs. Leaders must also ensure that these programs are embedded within quality teaching and learning practices, and that any professional development programs allow teachers to learn, reflect, practice and refine. Leaders must ensure professional development programs are based on a small number of participants, include hands-on activities and that training includes thorough follow-up and support. This school's leaders must manage the limited financial, physical and human resources to ensure that the technical platform on which ICT practices are delivered is established and effectively maintained.

Finally, as part of whole-school reforms for experienced teachers' use of ICTs, school leaders must acknowledge, encourage and promote the use of alternative methods of professional development for learning to use ICTs, they must increase the use of professional development that has a high impact on teachers' ICT practices, they must ensure that the content of professional development programs is based on pedagogy with embedded ICTs. They must also commit to engage in professional development themselves, with the purpose of ensuring that their own development of ICT practices mirrors those of experienced teachers.

7.6 Limitations of the research and conclusions

The limitations of the case study design revolve around the participant selection, the particular school involved, the rapid change of ICTs and measuring and using the term *Impact*. While the participant pool included experienced teachers that matched the specified criteria, it could be assumed that because all six teachers freely agreed to volunteer for the interviews, each had a positive attitude and perception in relation to ICT practices. Within the participant pool, there would have been, nonetheless, teachers who were change weary, had a negative attitude towards ICT or who were much less confident. This same set of dynamics could also be identified in terms of the survey. From a participant pool of approximately 40 teachers, 16 engaged with the survey, and again, it is possible to suggest that those who willingly participated might have had a more positive attitude in relation to their ICT practices.

The second limitation is that these findings and conclusions only relate to the specific school site where the research was conducted. While some inferences can be made and applied to other schools, many variables exist and there can be no

assurance that the findings and conclusions from this current case can be effectively applied to other school sites. In addition, further limitations in applying the results of this research to other school environments revolve around the fact that the Queensland state school where this research was conducted specifically displayed the following characteristics:

- The school does not operate a 1:1 laptop-learning environment and therefore the findings from this study have relevance only to environments with a similar infrastructure.
- This school could be classified as a large suburban, high school and is relatively new (in operation for 15 years) and therefore its culture is not one steeped in long-standing traditions. The youthful nature of the school means the school culture is still forming; however, the school is a high-achieving academic school with a focus on academic achievement, results and data.

The third limitation is the constantly evolving cycle of ICTs. Since the data was collected and the analysis finalised, a year has lapsed. During that time, new innovations in ICT infrastructure (e.g. BYOD), new software and additional professional development has been attended, which could affect any findings.

The final limitation is based around the measurement and use of the term impact. Impacts on teachers' ICT practices can be tangible or intangible. Tangible impacts on ICT practices may include the adoption of a new ICT device, ICT software or a particular website. These impacts can be visually observed and their use discussed with both students and teachers and as such their use and impact can be easily measured. Intangible impacts relate to an increase in knowledge and skills, a change in a teachers motivation or confidence and a change in their attitude or perception towards ICT practices. These impacts cannot be visually observed, but can be discussed with both teachers and students. Depending on a teachers' temperament, intangible impacts may not be as obvious to an outsider or a teachers' peers and therefore are not as easily identified or measured. Intangible impacts also do not have a starting and ending point but rather a continual process of development as teachers reflect on their beliefs and gain new knowledge and skills. During this research it became evident that most of the impacts from professional development where resulting in intangible impacts on teachers' ICT practices. With the benefit of

hindsight, modification to the data gathering instruments, in particular the survey, with focussed questions relating to the measurement of intangible impacts, such as knowledge, skills, values, beliefs, attitude, motivation and confidence may have provided more data for further analysis and discussion.

7.7 Recommendations for this study site

Based on the results, analysis, discussion and conclusions, a series of recommendations are provided as a guide to the administration team of the school studied in this research, which is looking to increase the use of ICT practices within classrooms. Recommendations have been provided for both research questions, including current ICT practices and professional development models.

These recommendations relate to experienced teachers' *perceptions* of their current ICT practices:

- The use of ICT practices by teachers needs to evolve to move from use outside the classroom to incorporate ICT practices that encourage students to think creatively and critically.
- School leaders and teachers need to be aware of and understand the existing and new obstacles that prevent teachers from fully utilising ICTs in their classrooms.
- Teachers who are considered *innovators* or *early adopters* should be encouraged to upward manage the school's leadership in ICT practices, which should help to evolve and improve ICT use and culture across the school. *Innovators*, *early adopters* and *early majority* teachers should be given the scope to take risks to trial and test ICT practices with the purpose of improving student outcomes.

Schools prioritise their improvement agendas; therefore, the use of ICTs by teachers needs to evolve from use outside the classroom to a model in which ICTs are used inside the classroom to encourage students to thinking creatively, critically, and to allow students to make connections and collaborate. For this to occur, this school's culture and its leaders must evolve, and the range of new and existing obstacles that prevent the growth of the teachers' ICT use must be acknowledged.

These recommendations relate to the *impact* that professional development had on experienced teachers' ICT practices:

- Alternative methods of professional development must be recognised and promoted for all teachers, particularly those professional development methods that teachers are completing in their own time.
- The school's leaders must adapt to changing and evolving professional development methods for learning ICTs.
- Underutilised professional development methods, including formal observation, structured online courses and learning from school technicians, should be used more.
- The focus for future professional development programs in ICTs needs to be on pedagogical practices that will support and enhance learning, specifically creative and critical thinking.
- The teachers' engagement is essential in order to have any positive impact on classroom practice. Therefore, it is recommended that any professional development offered in the area of ICTs is differentiated for specific staff, contextualised, offered in a small-group environment, is hands-on, includes elements of practice and trialability and provides thorough follow-up and support.
- The concepts of trialability, practice, risk taking and innovation can increase a teacher's motivation to learn. The concept of trialability should be encouraged in the professional development used by this school's teachers.
- It is recommended that the school leaders prioritise their own development and engagement with ICTs by observing those teachers considered to be innovators and early adopters of technology.

The focus of any professional development for teachers in relation to ICTs must be based on quality teaching and learning pedagogical practices with the seamless inclusion of ICTs. Adoption of the recommendations outlined in this section will assist in re-culturing this study sites' whole-school ICT culture and professional development programs.

7.8 Practical suggestions to address the challenges for teachers and school leaders at this study site

Any change to teachers' ICT practices is hampered by ineffective technological platforms. A full audit on the reliability and performance of a network's infrastructure and individual devices must be undertaken to ensure that technical obstacles are minimised before commencing a change agenda with teachers. The challenge for all parties revolves around beliefs, values, priorities and accountability. School leaders and teachers must ensure that students attain literacy and numeracy benchmarks and academic achievements, and that human, physical, financial and human resources are managed well. Organisations in industry allocate many more resources to managing network infrastructure and physical resources than schools do. School principals are under their own pressure from regional directors and regional strategic priorities that may conflict with the concepts of innovation, risk taking and trialability. The concept of upward managing extends to both regional and school-based hierarchies.

7.9 Future research

Given that two of the themes identified in this research include concepts of change and evolution, ongoing and sustained research into ICT practices and professional development of teachers in relation to ICTs is required. Four suggestions for research topics have been identified to extend the scope of this research. The first three are based on the school identified in this research.

1. *What is the most appropriate model for ICT practices within the classroom to enhance students' creative and critical thinking?* The findings of this research would inform future professional development agendas in relation to teachers' use of ICTs at this school.

2. *What are the new challenges and barriers to implementing ICT practices within a classroom?* The nature of these new challenges and barriers must be clearly identified and understood in order to inform future planning and change agendas. This research would assist this school to develop appropriate solutions.

3. *What is the impact of alternative methods of professional development and how can these methods be more effectively utilised?* This research should be undertaken so that this school's resources are maximised. In the case of formal observation of other school staff, specific research on the impact that this method of professional development has on teacher practices is recommended.

4. *What can be learnt from other educational settings and teacher types?* For example, primary schools could be investigated and the research could involve different demographics within the participant group, such as younger teachers, to ascertain differences in knowledge, motivation and confidence among teachers.

7.10 Concluding thoughts

Schools and school leaders are expected to be on a continuum of improvement. Explicit improvement agendas, annual implementation plans and benchmarked learning outcomes highlight that change management is a priority. In order to support staff through any change and build their capability, school resources must be effectively utilised. The methods of professional development that have the highest impact on building staff capability must be identified and implemented and constantly reviewed and reflected upon, to ensure maximum benefits are obtained.

References

Aronson, J. (1994). *A Pragmatic View of Thematic Analysis.* The Qualitative Report, 2(1).

Australian Curriculum Assessment and Reporting Authority. (2012). *National Curriculum. The Shape of the Australian Curriculum: English, Mathematics, Science and History.* Retrieved 8 July 2012, 2012, from http://www.acara.edu.au/curriculum/phase_1_-_the_australian_curriculum.html

Australian Institute for Teaching and School Leadership. (2011). *Australian Charter for the Professional Learning of Teachers and School Leaders A shared responsibility and commitment* (pp. 8). Melbourne: AITSL.

Baek, Y., Jung, J., & Kim, B. (2008). *What makes teachers use technology in the classroom? Exploring the factors affecting facilitation of technology with a Korean sample.* Computers and Education, 50(1), 224-234. doi: 10.1016/j.compedu.2006.05.002

Balanskat, A., Blamire, R., & Kefala, S. (2007). *The ICT Impact Report – A review of students of ICT impact on schools in Europe:* European Schoolnet, European Commission's ICT Cluster.

Baskin, C., & Williams, M. (2006). *ICT Integration in schools: Where are we now and what comes next?* Australasian Journal of Educational Technology, 22(4), 18.

Bassey, M. (1999). *Case Study Research in Educational Settings*: Open University Press.

Becker, B., Dawson, P., Devine, K., Hannum, C., Hill, S., Leydens, J., . . . Palmquist, M. (2012). *Case Studies - Writing @CSU Guide.* Retrieved 2 November 2011, from http://writing.colostate.edu/guides/guide.cfm?guideid=60

Belland, B. (2009). *Using the theory of habitus to move beyond the study of barriers to technology integration.* Computers and Education, 52(2), 353-364. doi: 10.1016/j.compedu.2008.09.004

Bernard, H., & Ryan, G. (2010). *Analyzing qualitative data: Systematic approaches.* Los Angeles, CA: Sage.

Bingimlas, K. (2008). *Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of the Literature* Eurasia Journal of Mathematics, Science and Technology Education, *5*(3), 235-245.

Bitter, G. G., & Legacy, J. M. (2008). *Using technology in the classroom* (7th ed.). Boston: Pearson/Allyn and Bacon.

Borko, H. (2004). *Professional development and Teacher Learning: Mapping the Terrain.* Educational Researcher, 33(8), 13.

Braun, V., & Clarke, V. (2006). *Using thematic analysis in psychology. Qualitative Research in Psychology, 3*, 77-101.

British Educational Communications and Technology Agency. (2008). *Analysis of emerging trends affecting the use of technology in education* (pp. 39). Coventry: University of Oxford.

British Educational Communications and Technology Agency. (2008). *Harnessing Technology: Next Generation Learning* (pp. 15). Coventry: Department for Innovation, Universities and Skills.

Brown Easton, L. (2008). *From Professional development to Professional Learning*. Phi Delta Kappan, 89(10), 12.

Cerutti, P., Brubaker, L., & Littler, E. (1969). *Students "Turn-On" to Classroom Computer* (Vol. 90): Project Innovation, Inc.

Chabi, A. H., Kboubi, F., & Ahmed, M. (2011). *Thematic Analysis and Visualization of Textual Corpus.* International Journal of Computer Science & Engineering Survey, 2(4), 16.

Cilesiz, S. (2010). *A phenomenological approach to experiences with technology: current state, promise, and future directions for research.* Association for Educational Communications and Technology, 59, 487-510. doi: 10.1007/s11423-010-9173-2

Cohen, D. (1987). *Educational Evaluation and Policy Analysis.* Educational Technology, Policy and Practice, 9(2), 17.

Coley, R., Cradler, J., & Engel, P. (1997). *Computers and Classrooms: The Status of Technology in U.S. Schools. Policy Information Report*.

Condie, R., Munro, B., Muir, D., & Collins, R. (2005). *The Impact of ICT Initiatives in Scottish Schools:* Phase 3 (Scottish Executive Education Department, Trans.) (pp. 176). Glasgow: University of Strathclyde.

Connelly, F. M., He, M. F., & Phillion, J. (2008). *The SAGE handbook of curriculum and instruction*. Los Angeles: Sage Publications.

Cramer, D. *Introduction to Research Methods in Psychology*.

Crook, C., Harrison, C., Farrington-Flint, L., Tomas, C., & Underwood, J. (2010). *The Impact of Technology: Value-added classroom practice, Final Report* (pp. 93). London: BECTA.

Cuban, L. (1986). *Teachers and Machines The Classroom Use of Technology Since 1920*. New York: Teachers College Press.

Cuban, L. (2001). *Oversold and Underused Computers in the Classroom*: Harvard University Press.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). *High access and low use of technologies in high school classrooms: Explaining an apparent paradox.* American Educational Research Journal, 38(4), 813-813.

Culp, K., Honey, M., & Mandinach, E. (2003). *A Retrospective on Twenty Years of Education Technology Policy* (U S Department of Education Office of Educational Technology, Trans.): Education Development Center.

Darling-Hammond, L., & Bransford, J. (Eds.). (2005). *Preparing Teachers for a Changing World* (1st ed.): Jossey-Bass.

Darling-Hammond, L., & Richardson, N. (2009). *Teacher Learning: What Matters?* Educational Leadership, 66(5), 46-53.

Department of Education Employment and Workplace Relations. (2008). *Digital Education Revolution - Strategic Plan.* Retrieved July 8, 2012, from http://www.deewr.gov.au/Schooling/DigitalEducationRevolution/Pages/default.aspx

Drent, M., & Meelissen, M. (2008). *Which factors obstruct or stimulate teacher educators to use ICT innovatively?* Computers and Education, 51(1), 187-199. doi: 10.1016/j.compedu.2007.05.001

Dunn, K., & Rakes, G. (2010). *Learner-centeredness and teacher efficacy: Predicting teachers' consequence concerns regarding the use of technology in the classroom.* Journal of Technology and Teacher Education, 18(1), 57-83.

Education Queensland. (2009, 2012). *Smart Classrooms.* Retrieved 2 November 2012, from http://education.qld.gov.au/smartclassrooms/

Education Queensland. (2011). *Smart Classrooms: A strategy for 2011-2014* (E. Queensland, Trans.) (pp. 6): Queensland Government.

Education Queensland. (2012). *Smart Classrooms - Professional development Framework. Retrieved* 2 November 2012, from http://education.qld.gov.au/smartclassrooms/documents/developing-professionals/pdf/professional development-framework.pdf

Eng, T. S. (2005). *The impact of ICT on learning: A review of research.* International Education Journal, *6*(5), 15.

Erstad, O. (2009). Addressing the complexity of impact - A multilevel approach towards ICT in education. In F. Scheuermann & F. Pedro (Eds.), *Assessing the effects of ICT in Education* (pp. 21-38). Luxembourg: Office of the European Union.

Ertmer, P. A., & Ottenbreit-Leftwich, A. (2010). *Teacher Technology Change: How Knowledge, Confidence, Beliefs, and Culture Intersect.* Journal of Research on Technology in Education, 42(3), 255-284.

Fouts, J. (2000). *Research on Computers and Education: Past, Present and Future* (pp. 60). Seattle: Bill and Melinda Gates Foundation.

Fullan, M. G. (1995). Professional development in Education. In T. R. Guskey & M. Huberman (Eds.), *New Paradigms & Practices* (pp. 253-267): Teachers College Press.

Fullan, M. G. (2002). *The Change Leader.* Educational Leadership, 59(8).

Garet, M., Porter, A., Desimone, L., Birman, B., & Yoon, K. S. (2001). *What Makes Professional development Effective? Results from a National Sample of Teachers.* American Educational Research Journal, 38(4), 30.

Gibson, W., & Brown, A. (2009). *Working with Qualitative Data*: Sage.

Gilbert, R. (2011). *Professional Learning Flagship Program: Leading Curriculum Change (*C. o. Australia, Trans.) (pp. 48): Australian Institute for Teaching and School Leadership.

Gillard, S., Bailey, D., & Nolan, E. (2008). *Ten Reasons for IT Educators to Be Early Adopters of IT Innovations.* Journal of Information Technology *Education, 7*, 21-33.

Guskey, T., & Yoon, K. S. (2009). *What Works in Professional development?* Phi Delta Kappan, 90(7), 495-500.

Guskey, T. R. (2005). *Taking a second look at Accountability* Journal of Staff Development (Vol. 26, pp. 10).

Guskey, T. R., & Huberman, M. (Eds.). (1995). *Professional development in Education:* Teachers College Press.

Hargreaves, A., & Fullan, M. (Eds.). (1992). *Understanding Teacher Development.* New York: Teachers College.

Harrington, J. (2009). *Technology and Society*: Jones and Bartlett Publishers.

Harrison, F. L. (1977). *The Computer Education Problem.* Journal of European Industrial Training, 1(4), 3-5.

Hattie, J. A. C. (2009). *Visible Learning, A Synthesis of over 800 Meta-Analyses relating to achievement*. Oxon: Routledge.

Hixon, E., & Buckenmeyer, J. (2009). *Revisiting Technology Integration in Schools: Implications for Professional development.* Computers in the Schools, 26(2), 130-146. doi: 10.1080/07380560902906070

Holkner, B., Romeo, G., Henderson, M., Auld, G., Russell, G., Tiong Seah, W., & Fernando, A. (2008). *Exemplar Schools: Using Innovative Learning Technologies (*Department of Education Employment and Workplace Relations, Trans.) (pp. 105). Victoria: Centre for Educational Multimedia.

Hooper, R. (1969). *A diagnosis of failure.* AV Communication Review, 17(3).

Hooper, R. (2008). *Educational technology—a long look back.* British Journal of Educational Technology, 39(2), 234-236. doi: 10.1111/j.1467-8535.2008.00813.x

Hurd, S. (2009). *Why has Computer Assisted Learning made so little impact in secondary education? Lessons from an economics and business subject case-study.* The Curriculum Journal, 20(2), 20.

Ingvarson, L. (2003). *Building a learning profession.* Australian Council for Educational Research(3), 29.

Institute of Educational Technology. (2012). *Institute of Educational Technology.* Retrieved October 14, 2012, 2012, from http://www8.open.ac.uk/iet/main/about-iet/history-iet

Jamieson-Proctor, R., & Finger, G. (2010). *ACT to Improve ICT Use for Learning: A synthesis of studies of Teacher Confidence in Using ICT in two Queensland schooling systems.* Australian Educational Computing, 23(2), 7.

Jayaram, K., Moffit, A., & Scott, D. (2012). *Breaking the habit of ineffective professional development for teachers.* In M. a. Company (Ed.), (pp. 12). Chicago: McKinsey and Company.

Jimoyiannisa, A., & Komis, V. (2007). *Examining teachers' beliefs about ICT in education: implications of a teacher preparation programme.* Teacher Development, 11(2), 149-173.

Johnson, B., & Christensen, L. (2008). *Educational Research - Quantitative, Qualitative and Mixed Approaches, 3rd Edition* (3rd ed.): Sage Publications.

Johnson, L., Adams, S., & Haywood, K. (2011). *The NMC Horizon Report: 2011 K-12 Edition.* In N. M. Consortium (Ed.), (pp. 40). Austin, Texas: The New Media Consortium.

Johnson, L., Smith, A., Smith, R., & Stone, S. (2010). *The 2010 Horizon Report* (pp. 35). Austin, Texas: The New Media Consortium & Educause Learning Initiative.

Kendall, G., & Wickham, G. (1999). *Using Foucault's methods*. London: Sage.

Kulik, C., & Kulik, J. (1991). *Effectiveness of Computer-Based Instruction: An Updated Analysis.* Computers in Human Behaviour, 7, 19.

Kulik, J. A. (1983). *Synthesis of Research on Computer-Based Instruction.* Educational Leadership, 41(1), 19-21.

Kyburz-Graber, R. (2004). *Does case-study methodology lack rigour? The need for quality criteria for sound case-study research, as illustrated by a recent case in secondary and higher education.* Environmental Education Research, 10(1), 14. doi: 10.1080/1350462032000173706

Lester, J. (2003). *Planning effective secondary professional development programs.* American Secondary Education, 32(1), 13.

MacDonald, R. (2008). *Professional development for Information Communication Technology Integration: Identifying and Supporting a Community of Practice through Design-Based Research.* Journal of Research on Technology in Education, 40, 429-446.

Maddux, C., Gibson, D., Dodge, B., Koehler, M., Punya, M., & Owens, C. (2011). *Research Highlights in Technology and Teacher Education 2011* (pp. 285): Society for Information Technology and Teacher Education.

Margaryan, A., Littlejohn, A., & Vojt, G. (2011). *Are digital natives a myth or reality? University students' use of digital technologies.* Computers & Education, 56, 11.

Margolin, J., & Misch, M. R. (1967). *Education in the Seventies, a Study of Problems and Issues Associated with the Effects of Computer Technology on Education.* Report: ED022361. 330pp. Oct 1967, 330.

Mayer, D., & Lloyd, M. (2011). *Professional Learning, An introduction to the research literature* (pp. 18). Melbourne: Australian Institute for Teaching and School Leadership Ltd.

McDonald, S. (2009). *A Model of Teacher Professional development based on the principles of Lesson Study.* (Professional Doctorate (Education)), Queensland University of Technology, Brisbane.

McGarr, O. (2009). *The development of ICT across the curriculum in Irish schools: A historical perspective.* British Journal of Educational Technology, 40(6), 1094-1108. doi: 10.111/j.1467-8535.2008.00903.x

McPhee, I. (2011). *Audit Report Performance Audit. Digital Education Revolution Program - National Secondary Schools Computer Fund* (Australian National Audit Office, Trans.) (Vol. No 30, pp. 148). Canberra: Department of Education Employment and Workplace Relations.

Mills, A., Durepos, G., & Wiebe, E. (Eds.). (2010). *Encyclopedia of Case Study Research* (Vol. 2). California: SAGE Publications.

Mishra, P., & Koehler, M. J. (2006). *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge.* Teachers College Record, 108(6), 1017-1054.

Mitchell, P., Stanelis, N., & Travers, J. (2010). *ICT Professional Learning: National mapping of ICT-related Professional Learning* (Department of Education Employment and Workplace Relations, Trans.) (pp. 90). Dulwich: Education Services Australia.

Molnar, A. (1997). *Computers in Education: A Brief History.* Retrieved 2 November 2012, 2012, from http://thejournal.com/Articles/1997/06/01/Computers-in-Education-A-Brief-History.aspx?Page=6

Morris, D. (2010). *Are teachers technophobes? Investigating professional competency in the use of ICT to support teaching and learning.* Procedia - Social and Behavioral Sciences, 2(2), 4010-4015. doi: 10.1016/j.sbspro.2010.03.632

Newhouse, P. C. (2002). *The Impact of ICT on Teaching and Learning* (pp. 73). Perth.

Ng, W., & Gunstone, R. (2010). *Science and computer-based technologies: attitudes of secondary science teachers.* Research in Science & Technological Education, 21(2), 23. doi: 10.1080/0263514032000127266

Norton, P., & Hathaway, D. (2011). *Impediments to Technology Integration: Individual Factors, School-Based Factors, and System-Wide Factors Identified by High-Using Technology Teachers*. Paper presented at the Society for Information Technology & Teacher Education International Conference 2011, Nashville, Tennessee, USA. http://www.editlib.org/p/36416

Organisation for Economic Co-operation and Development. (2010). *Are the New Millennium Learners Making the Grade? Technology Use and Educational Performance in PISA*: Center for Educational Research and Innovation.

Overbay, A., Patterson, A. S., & Grable, L. (2009). *On the Outs: Learning Styles, Resistance to Change and Teacher Retention.* Contemporary Issues in Technology and Teacher Education, 9(3), 350-370.

Pearson, M., & Naylor, T. (2006). *Changing contexts: Teacher professional development and ICT pedagogy.* Education Information Technology, 11, 283-291. doi: 10.1007/s10639-006-9013-5

Pelgrum, W. J. (2001). *Obstacles to the integration of ICT in education: results from a worldwide educational assessment*. Computers and Education, 37(2), 163-178. doi: 10.1016/s0360-1315(01)00045-8

Pelgrum, W. J., & Law, N. (2003). *ICT in education around the world: trends, problems and prospects* (pp. 29). Paris: United Nations Educational, Scientific and Cultural Organization.

Petras, C. M. (2010). *A descriptive study of science and mathematics teachers' pedagogy, ICT use and perceptions of how ICT impacts their teaching.* (Doctor of Education in Educational Technology), Pepperdine University.

Petrie, K., & McGee, C. (2012). *Teacher Professional development: Who is the learner?* Australian Journal of Teacher Education, 37(2).

Phelps, R., Graham, A., & Watts, T. (2011). *Acknowledging the complexity and diversity of historical and cultural ICT professional learning practices in schools*. Asia-Pacific Journal of Teacher Education, 39(1), 47-63. doi: 10.1080/1359866x.2010.541601

Pollard, C., & Pollard, R. (2004). *Research Priorities in Educational Technology: A Delphi Study.* Journal of Research on Technology in Education, 37(2), 17.

Queensland College of Teachers. (2012). *Continuing Professional Development Framework* Retrieved, 8 April 2015, from https://www.qct.edu.au/PDF/PSU/CPDFrameworkPolicy_AmendedforAustralianStandards.pdf

Riessman, C. (2008). *Narrative Methods for the Human Sciences*. CA, USA: SAGE Publications.

Roach, B. (2010). *Educational technology in the classroom from the Teacher's perspective.* (Doctor of Education), Fielding Graduate University.

Rogers, E. (2003). *Diffusion of Innovations* (5th ed.): Free Press.

Sahin, I. (2006). *Detailed Review of Rogers' Diffusion of Innovations Theory and Educational Technology-Related studies based on Rogers' Theory.* The Turkish Online Journal of Educational Technology, 5(2), 10.

Scheuermann, F., & Pedro, F. (2009). *Assessing the effects of ICT in education: Indicators, criteria and benchmarks for international comparisons.* In E. Commission (Ed.). Luxembourg: Office of the European Union/OECD.

Schoepp, K. (2005). *Barriers to Technology Integration in a Technology-Rich Environment.* Learning and Teaching in Higher Education: Gulf Perspectives, 2, 24.

Schuck, S., Aubusson, P., & Buchanan, J. (2008). *Enhancing teacher education practice through professional learning conversations.* European Journal of Teacher Education, 31(2), 215-227. doi: 10.1080/02619760802000297

Siemens, G. (2004). Connectivism: *A Learning Theory for the Digital Age.* from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.87.3793&rep=rep1&type=pdf

Sipila, K. (2010). *The impact of laptop provision on teacher attitudes towards ICT.* Technology, Pedagogy and Education, 19(1), 13.

Smith, I. (2005). *Continuing professional development and workplace learning 13: Resistance to change - recognition and response.* Library Management, 26(8/9), 519-522.

Stake, R. (1995). *The Art of Case Study Research*. University of Illinois at Urbana-Champaign, USA: SAGE Publications, Inc

Starkey, L. (2011). *Evaluating learning in the 21st century: a digital age learning matrix.* Technology, Pedagogy and Education, 20(1), 20. doi: 10.1080/1475939x.2011.554021

Tamim, R., Bernard, R., Borokhovski, E., Abrami, P., & Schmid, R. (2011). *What Forty years of Research says about the Impact of Technology on Learner: A Second-Order Meta-Analysis and Validation Study*. Review of Educational Research, 81(1), 28. doi: 10.3102/0034654310393361

Theisens, H., Roberts, K., & Istance, D. (2010). *Trends Shaping Education* (pp. 87): Organisation for Economic Co-operation and Development, OECD, Centre for Educational Research and Innovation.

Timperley, H. (2011). *A background paper to inform the development of a national professional development framework for teachers and school leaders.* (Australian Institute for Teaching and School Leadership, Trans.) (pp. 30). Melbourne: Australian Institute for Teaching and School Leadership.

US Department of Education. (2004). National Education Technology Plan 2004. *Toward A New Golden Age in American Education - How the Internet, the Law and Today's Students are Revolutionizing Expectations.* Retrieved 2 November, 2012, 2012, from http://www2.ed.gov/about/offices/list/os/technology/plan/2004/plan_pg14.html

US Department of Education. (2010). National Education Technology Plan 2010 Executive Summary (Office of Educational Technology, Trans.) *Transforming American Education Learning Powered by Technology* (pp. 26). Vancouver: US Department of Education.

Voogt, J., Knezek, G., Resta, P., & Searson, M. (2011). *Building a Global Community of Policy Makers, Researchers, and Teachers to Move Education Systems into the Digital Age: The EduSummIT 2011 Report* (pp. 8). Paris, France: Unesco.

Wachira, P., & Keengwe, J. (2011). *Technology Integration Barriers: Urban School Mathematics Teachers Perspectives.* Journal of Science Education and Technology, 20(1), 17-25. doi: 10.1007/s10956-010-9230-y

Warschauer, M. (2003). *Technology and social inclusion: rethinking the digital divide*. Cambridge, Mass; London: MIT Press.

Webb, M., & Cox, M. (2004). *A Review of Pedagogy Related to Information and Communications Technology.* Technology, Pedagogy and Education, 13(3), 52.

Webster-Wright, A. (2009). *Reframing Professional development through understanding authentic professional learning.* Review of Educational Research, 79(2), 37. doi: 10.3102/0034654308330970

Wells, J. (2007). *Key Design Factors in durable instructional technology professional development.* Journal of Technology and Teacher Education, 15(1), 21.

Wenglinsky, H. (1998). *Does It Compute? The Relationship between Educational Technology and Student Achievement in Mathematics.* In E. P. I. Centre (Ed.), (pp. 41). Princeton, NJ: Educational Testing Service.

White, G. (2008). *ICT Trends in Education Digital Learning Research*: Australian Council for Educational Research.

Yin, R. K. (1993). *Applications of Case Study Research*. Thousand Oaks, CA: Sage Publications.

Yin, R. K. (2009). *Case Study Research Designs and Methods* (4 ed. Vol. 5): Sage Publications, Inc.

Yoon, K. S., Duncan, T., Lee, S. W. Y., Scarloss, B., & Shapley, K. (2007). *Reviewing the Evidence on how Teacher Professional development Affects Student Achievement*: National Center for Educational Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

Appendix A: Survey

On a scale of 1 to 5 identify how crucial ICTs are to help you carry out the following standards, which have been identified by the Australian Institute for Teaching and School Leadership (AITSL). These are referred to as the National Professional Standards for Teaching.

Descriptor from the AITSL National Professional Standards for Teaching – Proficient level. Modified to include how ICTs can be used to carry out the practice.	**No ICT Use**	**Minor ICT Use**	**Mod-erate ICT Use**	**Major ICT Use**	**Total ICT Use**	**N/A**
Q1 On a scale of 1 to 5 identify how crucial ICTs are to help perform Standard 1 - Know students and how they learn.						
1. I use ICTs to identify and understand the physical, social and intellectual development and characteristics of my students.						
2. I use ICTs to understand how students learn including accessing research and collegial advice.						
3. I use ICTs to design and implement effective teaching strategies for students from diverse linguistic, cultural, religious and socioeconomic backgrounds.						
4. I use ICTs to design and implement effective teaching strategies for Aboriginal and Torres Strait Islander students.						
5. I use ICTs to differentiate teaching to meet the specific learning needs of students across the full range of abilities.						
6. I use ICTs to develop and implement strategies to support full participation of students with disability.						
Q2 On a scale of 1 to 5 identify how crucial ICTs are to help perform Standard 2 – Know the content and how to teach it.						
1. I use ICTs to develop knowledge of my content area and appropriate teaching strategies to develop engaging teaching activities.						
2. I use ICTs to select and organise content into coherent, well-sequenced programs.						
3. I use ICTs to design and						

implement learning and teaching programs based on curriculum documents (eg syllabus/work programs) and assessment and reporting requirements.	
4. I use ICTs to increase my understanding and respect of Aboriginal and Torres Strait Island people to provide opportunities to promote reconciliation between indigenous and non-indigenous Australians.	
5. I use ICTs to increase my knowledge and understanding of effective teaching strategies to support students' literacy and numeracy achievement.	
6. I use ICTs to develop effective teaching strategies to integrate ICT into learning and teaching programs	

Q3 On a scale of 1 to 5 identify how crucial ICTs are to help perform Standard 3 – Plan for and implement effective teaching and learning	
1. I use ICTs to establish explicit, challenging and achievable learning goals for all students.	
2. I use ICTs to plan, structure and sequence learning programs that engage students and promote learning	
3. I use ICTs to select and use relevant teaching strategies to develop students' knowledge, skills, problem solving, and critical and creative thinking.	
4. I use ICTs to select, create or use a range of resources that engage students in their learning	
5. I use ICTs to assist with effective classroom communication to support student understanding, participation, engagement and achievement.	
6. I use ICTs to evaluate and improve teaching programs using evidence from student feedback and student assessment data.	
7. I use ICTs to help engage parents/carers to be involved in their children's learning.	
Q4 On a scale of 1 to 5 identify how crucial ICTs are to help perform Standard 4 – Create and maintain supportive and safe learning environments.	

1. I use ICTs to support student participation by establishing and implementing positive and inclusive interactions to engage and support all students.	
2. I use ICTs to manage classroom activities including establishing and maintaining orderly routines to create an environment where student time is spent on learning tasks	
3. I use ICTs to manage challenging behaviour, including establishing and negotiation clear expectations with students and address discipline issues promptly, fairly and respectfully	
4. I use ICTs to maintain student safety by implementing school, system, curriculum and legislative requirements.	
5. I use ICTs safely, responsibly and ethically by using strategies that promote this to students.	
Q5 On a scale of 1 to 5, identify how crucial ICTs are to help perform Standard 5 - Assess, provide feedback and report on student learning.	
1. I use ICTs to develop, select and use informal and formal, diagnostic, formative and summative assessment strategies to assess student learning.	
2. I use ICTs to provide timely, effective and appropriate feedback to students about their achievement relative to their learning goals.	
3. I use ICTs to understand and participate in assessment moderation activities to support consistent and comparable judgements of student learning.	
4. I use ICTs to review student assessment data to analyse and evaluate student understanding of subject/content, identifying interventions and modifying teaching practice.	
5. I use ICTs to report clearly, accurately and respectfully to students and parents/carers about student achievement, making use of accurate and reliable records.	

PART B - Types of professional development. This question will gather information about the most frequent types of professional development attended or used by teachers.
Question 6: In the last TWO years how often have you attended or used the different types of professional development that addressed teachers' ICT practices?

PD Identifier Number	Types of professional development most frequently attended or accessed	None	Once or twice per year	Each term	Once or twice per month	Weekly or daily
1.	Domain meetings where colleague/s led a session on ICT practices					
2.	Staff meeting where colleague/s provided information or a demonstration of ICT practices					
3.	Small group – e.g. school-based workshops, student free day professional development sessions, faculty organised sessions etc					
4.	Conference					
5.	External course or workshop					
6.	Structured online course					
7.	Online learning via EQ resources - e.g. Learning Place, Atomic Tutorials, iConnect etc					
8.	Informal online learning through tutorials or other resources – e.g. YouTube, Khan Academy etc					
9.	Learning from your direct supervisor e.g. Head of Department or Deputy Principal					
10.	Peer mentoring from colleague in own faculty					
11.	Peer mentoring from colleague in other faculty					
12.	Peer mentoring from school technicians					
13.	Books or other print references					
14.	Formal observation of another colleagues' practice e.g. Viewing room					
15.	Informal observation of another colleagues' practice e.g. team teaching					
16.	Professional learning networks – e.g. either online or face-to-face but involve colleagues outside of your primary location					
17.	Resources obtained from professional association memberships					
18.	Personal use at home					
19.	Learning from family or friends					
20.	Learning from students					
21.	Self-taught trial and error					

22.	Emails or mailing lists
23.	Social media - e.g. Twitter or Facebook

PART C - Attitudes toward professional development. This question will gather information about the impact that different types of professional development had on teachers' ICT practices.
Question 7: In relation to the professional development that you have attended or used, identify which of these had an impact on your ICT practices and the scale of the impact. Impact is defined as a transformation of your teaching practice that resulted in an improvement to students' learning outcomes.

PD Identifier Number	Types of Professional development most frequently attended or accessed	N/A – Did not attend or use	No Impact or negative impact	Minor Impact	Mod-erate Impact	Major Impact	Total Impact
1.	Domain meetings where colleague/s led a session on ICT practices						
2.	Staff meeting where colleague/s provided information or a demonstration of ICT practices						
3.	Small group – e.g. school-based workshops, student free day professional development sessions, faculty organised sessions etc						
4.	Conference						
5.	External course or workshop						
6.	Structured online course						
7.	Online learning via EQ resources - e.g. Learning Place, Atomic Tutorials, iConnect etc						
8.	Informal online learning through tutorials or other resources – e.g. YouTube, Khan Academy etc						
9.	Learning from your direct supervisor e.g. Head of Department or Deputy Principal						
10.	Peer mentoring from colleague in own faculty						
11.	Peer mentoring from colleague in other faculty						
12.	Peer mentoring from school technicians						
13.	Books or other print references						
14.	Formal observation of another colleagues' practice e.g. Viewing room						
15.	Informal observation of another colleagues' practice e.g. team teaching						
16.	Professional learning						

	networks – e.g. either online or face-to-face but involve colleagues outside of your primary location
17.	Resources obtained from professional association memberships
18.	Personal use at home
19.	Learning from family or friends
20.	Learning from students
21.	Self-taught trial and error
22.	Emails or mailing lists
23.	Social media - e.g. Twitter or Facebook

Appendix B: Interview

Part A – Teachers' perceptions of their current ICT practices

1) What is your teaching area?
2) How regularly do your students use laptops, desktops or tablets in your classes?
3) Do you have any issues with accessing and using laptops, desktops or tablets in your classes?
4) Do you encourage students to bring their own devices into your classes?
5) Identify the primary use of ICTs that you use in your teaching practice in the following areas:
    a. Administrative practices
    b. Curriculum planning
    c. Curriculum implementation
    d. Assessment
    e. Communication with parents, students and colleagues both in and out of school
6) Has the rollout of the NSSCF laptops changed your ICT practices?
    a. If yes, describe how
7) Are there any ICT or teaching practices that you haven't changed as a result of the NSSCF laptops?
8) Do you deliver the National curriculum? If no, go to next question.
    a. If yes, has the implementation of the National curriculum changed your ICT practices? Please describe
    b. If yes, are there any ICT practices that haven't changed as a result of the National curriculum?
9) The National curriculum and Education Queensland has developed policies on ICT Capability and ICT Expectations which include: Applying social and ethical protocols and practices; Investigating with ICT; Creating with ICT; Communicating with ICT; Managing and operating ICT.
    a. How familiar are you with these policies?
    b. Have these policies had an impact on your ICT practices?
    c. Do you believe you have the required necessary skills and knowledge to integrate ICTs as stated in these policies? If no, next question.
    d. If yes, how did you attain these skills and knowledge?

Professional Standards

10) Do ICTs help you to know your students and their learning styles? Can you provide an example?

11) Do ICTs help you to know your content? Can you provide an example?

12) Do ICTs help you to plan and implement effective teaching and learning? Can you provide an example?

13) Do you ensure that students have supportive and safe learning environments when using ICTs? Can you provide an example?

14) Do you use ICTs to assess, provide feedback and report on student learning? Can you provide an example?

Part B – Teachers' perceptions of the change in their ICT practices

These questions are based on 'A theoretical and instrumental framework for implementing change in ICT in education' (Tearle, 2004).

The whole school characteristics

1) Do you believe the school has a collaboratively developed culture that encourages ICT implementation?

2) Do you believe the leadership and senior management of the school promotes the use of ICT implementation?

3) Do you believe there is a positive and proactive attitude from external influences (eg Federal, State Government and technology suppliers) to develop ICT practices in schools?

The ICT implementation process

4) Do you believe the school has well-established processes to facilitate changes in ICT practices?

    a. If no, what processes would you like to change in order to improve ICT implementation?

5) Are there sufficient and reliable resources available to implement your preferred ICT practices?

    a. If no, what additional resources are required?

6) Are appropriate technical support structures in place to support teachers to encourage greater ICT implementation?

    a. If no, what additional technical support structures are required?

7) Is there recognition given or allocated of the time needed for the professional development of effective ICT practices?

8) Does the professional development program of ICT practices address pedagogical needs as well as ICT skills? If no, what pedagogical needs would you like addressed?

Individuals

9) Are you motivated to change your ICT practices?

    a. If yes, what motivates you to change your ICT practices?

    b. If no, what prevents or restricts you from changing your ICT practices?

Diffusion of Innovations (Rogers 2003)

These questions are based on the change process theory Diffusion of Innovations (Rogers, 2003).

Attributes of Innovations

10) To what degree do you believe using ICT practices will enhance your teaching? (Relative Advantage)

11) To what degree to you believe using ICT practices is consistent with the values, experiences and needs you have as a teacher? (Compatibility)

12) Do you perceive ICT practices as difficult to understand and use or simple to understand and use? (Simplicity and ease of use).

13) Can you give an example of where you have been dissuaded from using ICTs due to the process being difficult to understand or use. (Simplicity and ease of use).

14) Can you give an example of where you have quickly adopted ICTs due to the process being simple to understand or use. (Simplicity and ease of use).

15) To what degree are you able to experiment with the use of ICT practices in your classrooms with this having a negative impact? (Trialability)

16) Do you see the results of other teachers' ICT practices and to what degree does this result in you changing your practices? (Observable results)

17) Do you believe that ICT practices have evolved, become more flexible or changed accordingly to meet the needs of more teachers? (Reinvention)

18) Do you believe that professional development on ICT practices has evolved, is flexible or changed accordingly to meet the needs of more teachers? (Reinvention)

19) To what degree do you initiate, participate or observe any peer-to-peer conversations around the use of ICT practices. (Importance of peer-peer conversations and peer networks)

Categories of users (Show participant)

20) Which of the following best describes your approach to adopting ICT practices?

- Visionary, imaginative, explores new ICT ideas or processes, risk-taker, connects to peer networks outside of local site.
- Adopts change once connects are made, likes to be at the forefront and experiment, likes to lead and promote successes, persuasive.
- Requires proof of benefits to students, may deliberate/analyse before adopting new idea, works in with other priorities, likes to make informed decisions, prefers minimal disruption.
- Uncomfortable with risk or new ideas, prefers traditional methods, will adopt once the majority have adopted to avoid being left behind, may lack confidence in new innovations, can be sceptical.
- Believe there is a high risk in adopting ICT practices, prefers to control change, questions the benefit in using ICT practices, extremely cautious about change.

A model of Innovation – Decision process

When adopting new ICT practices teachers will go through several phases. This is modelled on Diffusion of Innovations theory of the innovation-decision process (Rogers, 2003) and other diffusion models such as Epidemic Models (Geroski, 2000)

21) Do you believe you have adequate information and knowledge to use ICTs as expected? (Knowledge) This can include 'what it is' and 'how it works'.

22) Do you believe the professional development in ICT that you have used or attended equips you with adequate knowledge to implement ICTs? (Knowledge)

    a. If no, what additional knowledge is required?

23) Does attending professional development in ICT persuades you to adopt new ICT practices?

    a. If no, are there other factors that persuade you to adopt ICT practices. (Persuasion)

24) To what degree can you make your decisions about the use of ICT practices or are you hampered by controls outside of your influence? (Decision)

25) Has your implementation of ICT practices been effective in reaching your teaching and learning goals? (Implementation)

26) What feedback do you receive from students, colleagues or supervisors on your use of ICT practices? (Confirmation)

Part C – Impact that professional development had on ICT practices.

Professional development includes: (this could include faculty meetings, staff meetings, workshops, conferences, external courses, online courses or resources - eg Google or YouTube, Learning Place, peer mentoring, books, observations, mailing lists, personal use at home, learning from family or friends, learning from students, self-taught, emails, social media or other methods)

Types and impacts of professional development

1) Describe your preferred type of professional development for learning about ICT practices.

2) How has attending or using professional development on ICTs impacted on your teaching practices?

3) From the professional development on ICTs that you have attended or used which one has had the biggest impact on your teaching practice? What was the impact?

4) From the professional development on ICTs that you have attended or used which one has had the least impact on your teaching practice? Why did this occur?

5) Have you participated in any professional development in relation to ICT where you have made a decision not to incorporate this into your practice? Why?

6) Identifying the professional development that you have most regularly used or attended (from the questionnaire), is there an alternative professional development type that you would prefer to use or attend.

Attitudes and perceptions

7) What motivates you to attend professional development on ICTs?

8) Do you intend to continue to learn about ICTs in future?

9) Where does ICTs professional development place in relation to your other professional development priorities?

Challenges or barriers towards effective professional development

10) Have you encountered any obstacles or barriers that have prevented the outcomes from professional development on ICT from being implemented?

11) Do you receive adequate follow-up and support from others after attending professional development?

Appendix C: Survey Data

Questions 1 to 5 - Survey

PART A - National Professional Standards for Teaching (Standards 1 to 5 only)	Average Result
Standard 1 - Know students and how they learn	
1. I use ICTs to: Select teaching strategies based on knowledge of students' physical, social and intellectual development and characteristics to improve student learning.	2.94
2. I use ICTs to: Structure teaching programs using research and collegial advice about how students learn.	3.31
3. I use ICTs to: Design and implement teaching strategies that are responsive to the learning strengths and needs of students from diverse linguistic, cultural, religious and socioeconomic backgrounds.	3.13
4. I use ICTs to: Design and implement effective teaching strategies that are responsive to the local community and cultural setting, linguistic background and histories of Aboriginal and Torres Strait Islander students.	2.25
5. I use ICTs to: Develop teaching activities that incorporate differentiated strategies to meet the specific learning needs of students across the full range of abilities.	3.25
6. I use ICTs to: Design and implement teaching activities that support the participation and learning of students with disability and address relevant policy and legislative requirements.	2.81
Standard 2 – Know the content and how to teach	
1. I use ICTs to: Apply knowledge of the content and teaching strategies of the teaching area to develop engaging teaching activities.	3.38
2. I use ICTs to: Organise content into coherent, well-sequenced learning and teaching programs.	3.44
3. I use ICTs to: Design and implement learning and teaching programs using knowledge of curriculum, assessment and reporting requirements.	3.69
4. I use ICTs to: Provide opportunities for students to develop understanding of and respect for Aboriginal and Torres Strait Islander histories, cultures and languages.	2.44
5. I use ICTs to: Apply knowledge and understanding of effective teaching strategies to support students' literacy and numeracy achievement.	3.06
Standard 3 – Plan for and implement effective teaching and learning.	
1. I use ICTs to: Set explicit, challenging and achievable learning goals for all students.	3.19
2. I use ICTs to: Plan and implement well-structured learning and teaching programs or lesson sequences that engage students and promote learning.	3.44
3. I use ICTs to: Select and use relevant teaching strategies to develop knowledge, skills, problem solving and critical and creative thinking.	3.13
4. I use ICTs to: Select and/or create and use a range of resources, including ICT, to engage students in their learning.	3.63
5. I use ICTs to: Implement effective verbal and non-verbal communication strategies to support student understanding, participation, engagement and achievement.	3.25
6. I use ICTs to: Evaluate personal teaching and learning programs using evidence, including feedback from students and student assessment data, to inform planning.	2.75
7. I use ICTs to: Plan for appropriate and contextually relevant opportunities for parents/carers to be involved in their children's learning.	2.25
Standard 4 – Create and maintain supportive and safe learning environments.	
1. I use ICTs to: Establish and implement inclusive and positive interactions to engage and support all students in classroom activities.	3.13
2. I use ICTs to: Establish and maintain orderly and workable routines to create an environment where student time is spent on learning tasks.	2.75
3. I use ICTs to: Manage challenging behaviour by establishing and negotiating clear expectations with students and address discipline issues promptly, fairly and respectfully.	2.31

4. I use ICTs to: Ensure students' well-being and safety within school by implementing school and/or system, curriculum and legislative requirements.	2.69
Standard 5 - Assess, provide feedback and report on student learning.	
1. I use ICTs to: Develop, select and use informal and formal, diagnostic, formative and summative assessment strategies to assess student learning.	3.31
2. I use ICTs to Provide timely, effective and appropriate feedback to students about their achievement relative to their learning goals.	3.00
3. I use ICTs to: Understand and participate in assessment moderation activities to support consistent and comparable judgements of student learning.	2.50
4. I use ICTs to: Review student assessment data to analyse and evaluate student understanding of subject/content, identifying interventions and modifying teaching practice.	3.19
5. I use ICTs to: Report clearly, accurately and respectfully to students and parents/carers about student achievement, making use of accurate and reliable records.	3.63
Average for all twenty-seven focus areas = Moderate ICT Use	**3.03**

Question 6 - Survey

PD identifier number	Types of professional development most frequently attended or accessed	Average result
1.	Domain meetings where colleague/s led a session on ICT practices	2.63
2.	Staff meeting where colleague/s provided information or a demonstration of ICT practices	2.75
3.	Small group – e.g. school-based workshops, student free day professional development sessions, faculty organised sessions etc	2.50
4.	Conference	1.50
5.	External course or workshop	1.44
6.	Structured online course	1.25
7.	Online learning via EQ resources - e.g. Learning Place, Atomic Tutorials, iConnect etc	1.56
8.	Informal online learning through tutorials or other resources – e.g. YouTube, Khan Academy etc	2.69
9.	Learning from your direct supervisor e.g. Head of Department or Deputy Principal	1.94
10.	Peer mentoring from colleague in own faculty	2.81
11.	Peer mentoring from colleague in other faculty	1.94
12.	Peer mentoring from school technicians	1.88
13.	Books or other print references	1.94
14.	Formal observation of another colleagues' practice e.g. Viewing room	1.31
15.	Informal observation of another colleagues' practice e.g. team teaching	1.69
16.	Professional learning networks – e.g. either online or face-to-face but involve colleagues outside of your primary location	1.88
17.	Resources obtained from professional association memberships	1.88
18.	Personal use at home	3.38
19.	Learning from family or friends	3.13
20.	Learning from students	2.81
21.	Self-taught trial and error	3.50
22.	Emails or mailing lists	2.75
23.	Social media - e.g. Twitter or Facebook	1.44

Question 7 - Survey

PD identifier number	Impact that professional development has on ICT practice	Average result
1.	Domain meetings where colleague/s led a session on ICT practices	2.38
2.	Staff meeting where colleague/s provided information or a demonstration of ICT practices	2.44
3.	Small group – e.g. school-based workshops, student free day professional development sessions, faculty organised sessions etc	2.93
4.	Conference	2.70
5.	External course or workshop	3.17
6.	Structured online course	3.40
7.	Online learning via EQ resources - e.g. Learning Place, Atomic Tutorials, iConnect etc	2.43
8.	Informal online learning through tutorials or other resources – e.g. YouTube, Khan Academy etc	2.58
9.	Learning from your direct supervisor e.g. Head of Department or Deputy Principal	2.00
10.	Peer mentoring from colleague in own faculty	2.73
11.	Peer mentoring from colleague in other faculty	2.67
12.	Peer mentoring from school technicians	2.92
13.	Books or other print references	2.45
14.	Formal observation of another colleagues' practice e.g. Viewing room	2.75
15.	Informal observation of another colleagues' practice e.g. team teaching	2.50
16.	Professional learning networks – e.g. either online or face-to-face but involve colleagues outside of your primary location	2.67
17.	Resources obtained from professional association memberships	2.71
18.	Personal use at home	3.13
19.	Learning from family or friends	3.07
20.	Learning from students	2.50
21.	Self-taught trial and error	3.13
22.	Emails or mailing lists	2.50
23.	Social media - e.g. Twitter or Facebook	2.00

Appendix D: Interview Data

Part A - Interview	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
1) What is your teaching area?	LOTE, English	SOSE	Science	Visual Arts	Maths	Business
2) How regularly do your students use laptops, desktops or tablets in your classes?	2 not regularly	2 yes, every lesson	2 yes, every lesson new tablets	2 yes, not operational, share computer room with other classes	2 not regularly, just received new tablets, hoping to use them more	2 yes every lesson in one faculty, sometimes in other faculty
3) Do you have any issues with regularly accessing laptops, desktops or tablets in your classes?	3 yes, access issues, no nsscf computers, can't get into computer room, big school	3 yes, login issues	3 yes, in the past access issues, access is good now	3 yes, iPads not functional, technical issues, very frustrating, want to use them for research, I learn from students, students use my laptop,	3 yes, can't get into computer room, big school, can't get access to locked laptops unless they are in room, not in every room, waiting for new tablets, login issues, access to key for nsscf laptops, missing keys on keyboards, nsscf computers are poorly cared for and maintained	3 yes, access to key for nsscf laptops
4) Do you encourage students to bring their own devices into your classes?	4 encourages BYOD	4 encourages BYOD, not encouraged in junior, concerns with Facebook and cyber bullying	4 accepts BYOD, iPad and smartphones are common in yr 11 & 12	4 encourages BYOD, due to access issues, allows for flexibility, self-pacing, useful in inquiry and research, useful in senior, not encouraged in junior	4 accepts BYOD, doesn't encourage, doesn't permit use of phones, sees the benefit with using laptops/tablets for eBooks, doesn't permit use as calculator, expects to see more BYOD	4 encourages BYOD only with senior committed learners, can be disruptive with less committed senior students as they texting, making calls, committed learners take photos of whiteboard and hardcopies, use eBooks, not encouraged in junior
5) Identify the primary use of ICTs that you use in your teaching practice in the following areas: a. Administrative practices	5a email	5a research, program writing	5a OneSchool, diary, iPad	5a differentiation, OneSchool,	5a IDattend, emails,	5a everything, try to operate paper free, spreadsheet records, data analysis
b. Curriculum planning	5b emailing students, planning lessons and units	5b research of best pedagogical practice	5b finding resources, photographing and scanning older print resources, planning lessons and units, OneNote difficult to use due to lack of familiarity	5b planning lessons and units, units on OneSchool	5b creating PowerPoint for lesson preparation, specialist software	5b accessing units on OneSchool, finding resources
c. Curriculum implementation	5c reinforce learning for students, academic games	5c reinforce learning for students, videos, data projector, PowerPoint	5c specialist software, inquiry, internet research	5c PowerPoint, online resources, data projector, taking photographs, organising students files	5c data projector, specialist software, automates simple processes which leaves time for analysis and higher order thinking	5c PowerPoint, data projector, backup to HDD,
d. Assessment	5d record audio files for students to listen to, self-pacing, differentiated learning	5d record audio and video of students' presentations, feedback, differentiated learning	5d email students, feedback to students in word, digital submission of junior assignments to mark online, conserve paper	5d email students, feedback to students in word, influenced by younger teachers with iPad, would like to use excel but it's too difficult	5d expect students to submit word processed assignments, teach students specific technical skills/advanced features in word, LearningPlace stores assessment	5d email students, digital submission, vocational subjects mark online, Spreadsheet for tracking results

					items, revision sheets, allows parents access	
e. Communication with parents, students and colleagues both in and out of school	5e email students homework, block emails to parents, good rate of reply, email colleagues, students using private email accounts	5e email students, email parents and email colleagues, concerns with Facebook	5e email students, students using both school and private email accounts email parents, more thorough, clearer message, preferred method, more convenient, good rate of reply, Email colleagues	5e email students, for written tasks not practical, follow-up with discussion, students email links to websites to show ideas, concerns with Facebook, No email to parents, digital files are disorganised	5e email parents, preferred method, more efficient, emails students, feedback to students in word, copy to parents, LearningPlace, students using both school and private email accounts	5e email parents, preferred method, more convenient, keeps a record of message given to parents, email colleagues, twitter for professional connections outside of school, twitter is best resource for new ideas
6) Has the rollout of the NSSCF laptops changed your ICT practices? a. If yes, describe how	6 no use of nsscf or impact	6 yes, used nsscf, more opportunities for inquiry learning	6 yes, used nsscf, no impact, login issues caused problems due to Wi-Fi	6 no use of nsscf or impact	6 yes, used nsscf, no major impact to date, commencing trial to test specialist software with senior classes, more integrated learning, will use to automate simple processes, allowing more time for analysis and higher order thinking	6 no use of nsscf or impact
7) Are there any ICT or teaching practices that you haven't changed as a result of the NSSCF laptops?	7 n/a	7 still rely on PowerPoint, data projector, could be doing more	7 theory concepts still taught traditionally, ICTs used to reinforce learning	7 n/a	7 n/a	7 n/a
8) Do you deliver the National curriculum? If no, go to next question. a. If yes, has the implementation of the National curriculum changed your ICT practices? Please describe	8 yes, OneNote difficult to use due to lack of familiarity, time consuming and tedious	8 yes, same strategies and processes, different content and skills, assessment is less ICT based	8 yes, same strategies and processes	8 no	8 yes, same strategies and processes, still rely on PowerPoint, online resources, potential is there driven by technology itself not by the curriculum	8 n/a
9) The National curriculum and Education Queensland has developed policies on ICT Capability and ICT Expectations which include: Applying social and ethical protocols and practices; Investigating with ICT; Creating with ICT; Communicating with ICT; Managing and operating ICT. a. How familiar are you with these policies?	9 Not familiar with policy name	9 Not overly familiar with policy name, but familiar with intent	9 Not overly familiar with policy name, but familiar with intent	9 Not familiar with policy name	9 Not familiar with policy name, but familiar with intent	9 Not overly familiar with policy name, but familiar with intent
b. Have these policies had an impact on your ICT practices?	9b yes, you all ICT skills, Social and ethical ICT – check for suitable websites	9b yes, use most ICT skills, broadened understanding of how	9b yes, use most ICT skills, Managing and operating ICT – use specialist equipment,	9b no, use some ICT skills, Managing and operating ICT – use specialist equipment,	9b yes, use most ICT skills, Managing and operating ICT – use specialist equipment Social and	9b yes, use all ICT skills

		ICT could be integrated, conducted audit in faculty and identified gaps in Social and ethical ICT	Investigating with ICT, Communicating with ICT, Social and ethical ICT – trusts students to do the right thing, Is a good role model, concerns with Facebook, Not skilled in Creating with ICTs	Investigating with ICT, Communicating with ICT, Creating with ICT	ethical ICT – check for suitable websites, direct students to educational based websites only, Not skilled in Creating with ICTs	
c. Do you believe you have the required necessary skills and knowledge to integrate ICTs as stated in these policies? If no, next question.	9c Yes skilled and knowledgeable	9c Not totally	9c Yes skilled and knowledgeable in most of them, Not skilled in Creating with ICTs.	9c Not totally	9c Yes skilled and knowledgeable in most of them, Not skilled in Investigating with ICT, Not skilled in Creating with ICT, Opportunities in creativity are limited in my faculty area, need to up-skill in this area,	9c Yes skilled and knowledgeable
d. If yes, how did you attain these skills and knowledge?	9d Trial and error, self-taught	9d didn't answer	9d didn't answer	9d attend professional development, need to be shown and then practice, trial and error, a lot to learn, very overwhelmed, needs more support	9d luck, self-taught, attend professional development, learn from husband and family, using an iPad	9d trial and error, learn from husband, specific role in school required these skills,
10) Do ICTs help you to know your students and their learning styles? Can you provide an example?	10 yes, appeals to students and this increases engagement	10 yes, to identify students temperaments, access OneSchool, which is very helpful	10 yes, email communication can give an insight, hasn't used OneSchool	10 conditional yes, used as a strategy for differentiation, to identify students temperaments, believes building personal relationships is the best way to get to know your students	10 not a great deal, I should do more, Oracle to identify students temperaments, access OneSchool, access differentiation plans	10 yes, email communication can build relationships, to identify students temperaments, data analysis, OneSchool, Oracle
11) Do ICTs help you to know your content? Can you provide an example?	11 yes absolutely, finding resources	11 yes absolutely, finding resources conduct research	11 yes, gather new resources or digitise older resources, experienced teacher so I'm confident I know my content area, conduct research, but prefers to ask a peer if available	11 yes, because you have to stay current, otherwise you are ineffective, specialist software, need to build more technical skills	11 yes, gather resources, conduct research, improve knowledge, experienced teacher so I'm confident I know my content area, research of best pedagogical practice to look for ways to make it more engaging or interesting for students	11 yes, gather resources, conduct research,
12) Do ICTs help you to plan and implement effective teaching and learning? Can you provide an example?	12 strongly yes, appeals to students, particularly boys, and this increases engagement	12 strongly yes, differentiated learning to cater for different temperaments, senior prefer self-paced learning, allows for Investigating with ICT in particular web quests.	12 yes, data projectors help convey new content and ideas, capture lessons to save and use later.	12 email students, feedback to students in word, improves implementation due to enhanced communication	12 yes, can make content more interesting and interactive	12 yes, using iObservation and ASoT framework, helps plan and implement and be more effective
13) Do you ensure that students have supportive and safe learning environments when using ICTs. Can you provide an example?	13 yes, students already aware	13 yes, yr 12s no issue, yr 9s have issues with safety in emails, concerns with Facebook and cyber bullying, need	13 yes, students already aware, minor issues with Facebook and cyber bullying,	13 yes, very concerned in this area, always asking students what they are doing or accessing, do have to build students' trust, easier to	13 yes, preview educational sites, most students have smartphones and use instead of calculators, which doesn't always suit, iPad/smartphones may make	13 yes, need to be aware and monitoring closely, talk to students about use, have class discussions on these topics, not a concern as long as you are

		to have classroom monitoring software,		monitor with juniors because I'm more vigilant with juniors	calculators obsolete	vigilant, it's manageable
14) Do you use ICTs to assess, provide feedback and report on student learning? Can you provide an example?	14 yes, specialist software allows instant feedback, email feedback, mark-ups in word, students using private email accounts	14 yes, email feedback, mark-ups in word, wants to use community clips, need practice time	14 yes, email feedback, mark-ups in word, copied to parents, reports in OneSchool good 24/7 access, would prefer personalised comments, big school	14 yes, email feedback, mark-ups in word but takes a long time and sometimes I revert to a hardcopy and write over it, follows up with conversation with students	14 yes, use smartphone or iPad to take photos of students work, email feedback, if students hand in hardcopy drafts, I will write on these and email back a photo/scan of suggestions, mark-ups in word, using photo/scan for faculty moderation of assignments to conserve paper wastage and avoid photocopying	14 email feedback, mark-ups in word, wants to use community clips, needs practice time
Part B - Interview						
1) Do you believe the school has a collaboratively developed culture that encourages ICT implementation?	1 yes, but there isn't enough time or support	1 not really, ICTs are not used to potential, primarily used for Investigating with ICTs and research, not always used effectively, some cultural issues with teachers using ICTs as a rest lesson	1 yes, it is constantly evolving, BYOD, more equipment available for use	1 strongly yes, a lot of good practice happening, contributes to frustration because there is so much to learn, feels overwhelmed and behind, puts pressure of self to do more,	1 yes, HODs encourage it	1 yes, it is encouraged, people adapt to change, influenced by younger teachers
2) Do you believe the leadership and senior management of the school promotes the use of ICT implementation?	2 yes, examples at staff briefing, domain meetings, it is a lower priority, could do more	2 strongly yes, examples at staff briefing, domain meetings, staff meetings	2 yes, staff briefing, staff meetings, promote use of OneSchool, admin are evolving too	2 yes, specifically with data, NAPLAN data, differentiation, ICTs don't come naturally to all staff – particularly older staff, we are encouraged to research and use online resources	2 yes, leaders are supportive, but may not be aware of what is happening in classes, teachers need to make leaders more aware of what they are doing	2 sometimes yes, sometimes no, a number of leaders may not fully understand digital pedagogies due to their own use of ICTs in the classroom when they were still teaching
3) Do you believe there is a positive and proactive attitude from external influences, eg Federal, State Government and technology suppliers, to develop ICT practices in schools?	3 no, not enough guidance, they need to adapt with new generation of students and change with the times	3 no, lower priority than literacy and numeracy	3 yes, they do what they can with equipment and professional development, big organisation across the state, teachers need to take responsibility for their own development in this area	3 yes, it is expected but not enough guidance, more guidance given in primary, not enough guidance in secondary	3 yes, they have with equipment, but need more funding for professional development	3 no, disappointed and frustrated over the years, previous LearningPlace was unwieldy, EQ insists on building own customised online resources, yet others freely exist and work on the web, OneSchool is fantastic, ongoing support needed for teachers,
4) Do you believe the school has well-established processes to facilitate changes in ICT practices? a. If no, what processes would you like to change in order to improve ICT implementation?	4 no, not enough funding for professional development, more promotion from leaders	4 no, not enough equitable access to equipment, needs monitoring to ensure it is being effectively used	4 yes, more technical support needed, more ICT leaders needed	4 yes, on planning days we have the opportunity to develop ICTs but this has to compete with other priorities, lower priority than literacy and numeracy due to school-wide data priority,	4 yes, HODs are encouraging and supportive, culture of some teachers is that they will only do what they have to, so they tend not to do extra professional development, always the scope to do more, could make teachers more aware of external opportunities	4 yes, staff can choose their own professional development, professional development that is offered is useful, staff are keen, lots of peer collaboration, lots happening
5) Are there sufficient and	5 no, we have enough	5 yes and no, enough	5 yes, some classes only have	5 unsure, not sure of all	5 yes, but we have network	5 Yes, want more iPads, good

reliable resources available to implement your preferred ICT practices? a. If no, what additional resources are required?	resources, technical problems not solved quickly enough	resources but lots of teachers want to use, inequitable distribution across faculties, difficult to access to key for nsscf laptops,	15 or 20, that's not enough, login time is slow	resources which are available, would like to use more online resources, iPads aren't functional due to technical reasons, students can't print in my room, we have to share equipment	infrastructure and login issues, I accept that and always have an alternative plan, would like more eBooks,	range of software resources available
6) Are appropriate technical support structures in place to support teachers to encourage greater ICT implementation? a. If no, what additional technical support structures are required?	6 no, inadequate communication and long turnaround of repair, older staff have a lot to learn and need support, issues with specialist software, technicians are very helpful and we need more of them	6 strongly yes,	6 yes, technicians are very helpful, I always ask nicely and show my appreciation, I try not to use them unless I have to	6 yes and no, technicians are very helpful, technicians are overwhelmed, big school, cycle of constant repair, leads to frustration for teachers, we get new equipment like iPads, who is available to teach me how to use it	6 yes, big school, funding issue, technicians are overwhelmed, utilise other staff not rely solely on technicians,	6 yes, technicians are good, technicians are overwhelmed, big school, all schools struggle with this
7) Is there recognition given or allocated of the time needed for the professional development of effective ICT practices?	7 no, too many small technical issues waste time, a lot is expected, if you have skills you are expected to mentor other staff without allocation of time	7 yes	7 yes, I balance any time allocated by putting in my own time, I ask very nicely	7 no	7 yes, I make sure that the Principal, DP and HODs know my interest and skill areas and I promote the outcomes, so that recognition and support is ongoing	7 No I don't think so, need to learn specialist software in own time as you are expected to teach it, teachers do need to use their own time, younger teachers adapt easier, older teachers need more support
8) Does the professional development program of ICT practices address pedagogical needs as well as ICT skills? If no, what pedagogical needs would you like addressed?	8 yes and no, practical examples are the best, some professional development is useless, when you attend professional development you want to leave feeling enthused and be reminded of what is available, some great professional development recently on online resources	8 yes, OneSchool is probably the biggest example as it provides information about students in order to adjust and develop different pedagogies	8 no, would like more professional development on pedagogies, not sure what is available, up to date with ICT skills	8 yes, it addresses both pedagogical and ICT skills, I need more professional development in ICT skills first, I need to see relevance and understand how effective it can be, I learn from students	8 yes and no, it addresses both pedagogical and ICT skills, would like more professional development on pedagogies, I need to see relevance and understand how effective it can be, needs to be subject specific	8 yes, it addresses both pedagogical and ICT skills, example of collaboration with ICTs
9) Are you motivated to change your ICT practices? a. If yes, what motivates you to change your ICT practices? b. If no, what prevents or restricts you from changing your ICT practices?	9 yes, really motivated and excited at present by new iPad at home, upcoming professional development, BYOD policy, what other schools and colleagues are doing, slightly worried about how much to learn, believes ICT helps in all areas of learning 9b n/a	9 yes, ICT is so interesting, subject specific applications are amazing, links to everything in career and home, personal interest, improves student engagement 9b Time, Don't want to miss classes by attending professional development, ICT skills are adequate so attending professional development is a lower	9 yes, I want to ensure that my students have future relevant skills 9b Time, Don't want to miss classes by attending professional development, ICT skills are adequate so attending professional development is a lower priority	9 yes, helps improve teaching and learning effectiveness, concerned about Facebook, not interested in blogs, sees an advantage, ICTs is not the preferred method of communication 9b So much to learn leads to feeling overwhelmed and frustrated, wants to up-skill	9 yes, helps improve teaching and learning effectiveness, improves student engagement, more interesting lessons 9b Time to learn, time to plan, technical issues but I can adapt, I have persistence to overcome technical issues, some teachers may not have the experience and skill to modify lesson if technical issues are disruptive, some teachers lack confidence	9 yes, links to everything in career and home, personal interest, increases efficiency 9b Time, Don't want to miss classes, ICT skills are adequate so lower priority

		priority				
10) To what degree do you believe using ICT practices will enhance your teaching? (Relative Advantage)	10 yes, increases engagement, academic games	10 yes, increases strategies	10 yes	10 yes, improves teaching and learning effectiveness, concern with Facebook, ICTs is not the preferred method of communication	10 yes, improves teaching and learning effectiveness, easier for students to understand concepts, ICTs can measure student understanding	10 yes, enhances my teaching and learning, but can still deliver effectively without it
11) To what degree to you believe using ICT practices is consistent with the values, experiences and needs you have as a teacher? (Compatibility)	11 yes, increases engagement by creating a fun learning environment	11 yes	11 yes	11 yes, appeals to students, essential to put yourself in the kids world	11 yes, always wants to improve and ICTs can help this, learn the use of ICT equipment and specialist software, research best practice,	11 yes, very compatible with my teaching and learning beliefs and practices
12) Do you perceive ICT practices as difficult to understand and use or simple to understand and use? (Simplicity and ease of use).	12 Both, sometimes difficult, hampered by EQ controls when wanting to use resources outside of the classroom	12 Both, not easy, it requires demonstration, practice, trial and error	12 Most are simple	12 Difficult, lacking in the foundation technical language which makes it more difficult to learn specialist software eg what is a proxy server	12 Both, depends on program and resources available, not necessarily difficult, just time consuming to learn,	12 Most are simple – am very persistent, able to work out by software use by myself, not interested in learning about hardware, so if hardware doesn't work, I'm at a loss
13) Can you give an example of where you have been dissuaded from using ICTs due to the process being difficult to understand or use. (Simplicity and ease of use).	13 Difficult example –online overseas chat, Skype is easy to use, by won't work on EQ network, EQ's suggestion - elluminate isn't easy to use, tutorial for use was overwhelmingly long and it didn't work when I tried to use it. Gave up. Online tutorial	13 Difficult example - MYOB, specialist software Self-taught	13 Difficult example - OneNote - didn't offer anything relevant for teaching, didn't see the point, couldn't be bothered. Self-taught	13 Difficult example - Excel, want to use it, been to two professional developments, one was badly presented, confusing, too many questions from others, group size too large Small group workshop	13 Difficult example - Previous LearningPlace put me off for a long time (6-8 years), was confusing to navigate and enrol students in courses, too many technical hurdles, I resisted new versions until recently when I saw what a new teacher at school had done, it was much easier to navigate, took a long time to have a second go at it External workshop	13 Difficult example - if the software doesn't meet a pedagogical or learning goal, it stays difficult because I don't find time to make it work. If I can make a link it becomes easier and I'm more motivated or able to learn it, OneNote - didn't offer anything relevant for teaching, didn't see the point, Self-taught
14) Can you give an example of where you have quickly adopted ICTs due to the process being simple to understand or use. (Simplicity and ease of use).	14 Simple example – Promethean and data projector because it was fun and I could make a lot of resources because there weren't any available. Self-taught	14 Simple example - YouTube, Video clips Self-taught	14 Simple example - Google inquiry, Paint	14 Simple example - when the process can be adapted from a manual process, when you have learnt a process in one program then it is easier to apply it in a similar type of program. Eg image editing software. If you learn it in Photoshop then it can cross over to something similar.	14 Simple example - New LearningPlace, PowerPoint	14 Simple example - PowerPoint
15) To what degree are you able to experiment with the use of ICT practices in your classrooms with this having a negative impact? (Trialability)	15 no, too disruptive in class, takes too much time	15 yes, in yr 12 and well behaved junior classes, I will tell the students were are testing something through trial and error, I learn from students,	15 yes, happy to let them explore	15 yes, I don't trial things, but students can	15 yes, I received some peer support regarding the data projector, as I had attended a professional development 6 months ago but had forgotten how to use is. Visited a colleagues class and he should me a few things – this was a good reminder.	15 yes, I don't feel as though I have to know everything, I learn from students, I know enough and then defer to students to problem solve or peer support each other

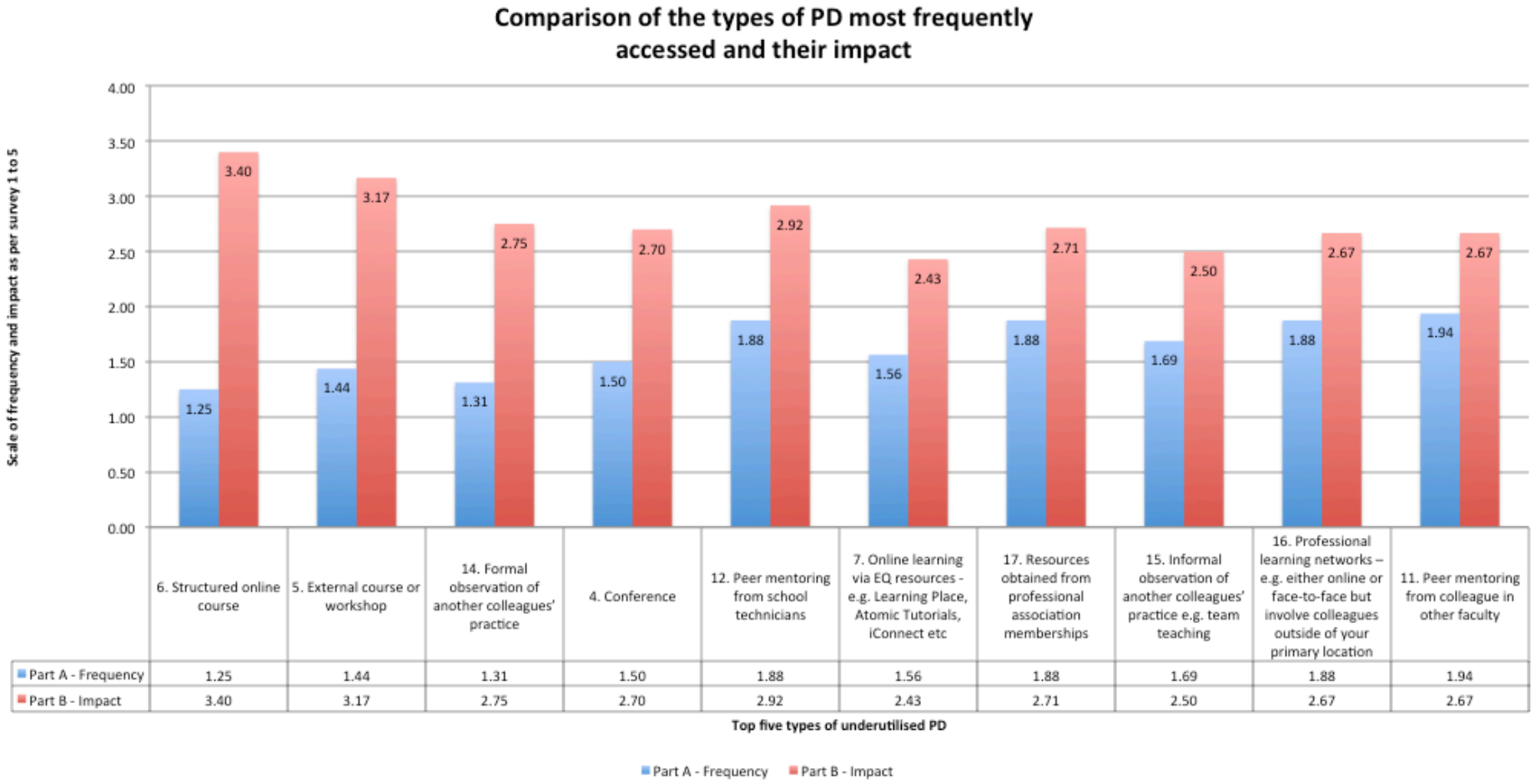
16) Do you see the results of other teachers' ICT practices and to what degree does this result in you changing your practices? (Observable results)	16 no, not in others classes, only at briefing, ineffective due to format, only relates to specific subjects	16 yes, it's a good reminder of how important it is as it improves students learning, inspires new ideas, reminder of what not to do	16 yes, inspires new ideas, able to modify the idea for my classroom	16 yes and no, has a negative impact, as it makes me feel incompetent, positive impact, inspires new ideas, but it is time consuming to learn, revert back to what I know	16 yes, with data projector, LearningPlace from two other teachers, inspires new ideas,	16 yes, can learn from other teachers, able to modify the idea for my classroom, seeing it in action makes it easier to apply to own classroom
17) Do you believe that ICT practices have evolved, become more flexible or changed accordingly to meet the needs of more teachers? (Reinvention)	17 yes, need to be selective due to number of different options, need assistance to select best practice	17 yes, more choice, easier to find, more staff sharing	17 yes, more equipment, more access, more choice	17 yes, easier to use, more user friendly, more choice can add complexity and cause confusion, need assistance to select best practice	17 yes, it is improving, LearningPlace is easier, ICTs are evolving and becoming easier, for example, eBooks, online resources	17 yes, sometimes we jump in too quick, yes it is flexible, ICTs have improved communication, OneSchool while good at data collation and analysis, has taken teachers a while to adapt, OneSchool has had a dramatic change
18) Do you believe that professional development on ICT practices has evolved, is flexible or changed accordingly to meet the needs of more teachers? (Reinvention)	18 yes absolutely, excited about apps	18 not really, not suitable for ICT beginners, presenters expect increased skill, best to learn from technicians or peers	18 yes, is more Hands-on	18 not really, Not suitable for ICT beginners, balancing ICTs with other priorities causes issues, ICTs can be complex	18 slowly, not as fast as ICT	18 yes, more in-house people can professional development other teachers, more cost effective for schools now
19) To what degree do you initiate, participate or observe any peer-to-peer conversations around the use of ICT practices. (importance of peer-peer conversations and peer networks)	19 yes, always seeking help, not everyone participates as some teachers seem too busy	19 yes, more regular, more staff involved	19 yes, more regular, more staff involved, young teachers are a positive influence	19 yes, inspired by other teachers who are technologically skilled, not overly swayed due to own feelings of inadequacy, influenced by students, but students have to be independent and learn by themselves or from each other	19 yes, I don't initiate, I participate, contribute and share, some people are prepared to share, others aren't, others are resistant to the use of ICTs	19 yes, with peer networks, if people don't see how it will help them, they won't engage or put the effort into learning, some people are fearful of asking questions about pedagogy as they feel it might reflect poorly on them, need to convince people that it is going to directly benefit them
Categories of users (Show participant) 20) Which of the following best describes your approach to adopting ICT practices? • Visionary • Adopts • Requires proof of benefits to students • Uncomfortable with risk • Believe there is a high risk	20 Innovator	20 Early adopter	20 Early adopter	20 Early majority	20 Early adopter, likes to explore new ideas	20 Early adopter
21) Do you believe you have adequate information and knowledge to use ICTs as expected? (Knowledge) This can include 'what it is' and 'how	21 yes, skilled	21 not totally	21 yes, skilled with finding resources and internet research but need to up-skill with specialist software	21 not totally, yes with PowerPoint and Internet research, but websites are often blocked by EQ. Yes with the use of data projector and	21 not totally, need more up-skill in specialist software, data projector	21 yes, if I don't, I'm able to up-skill, largely self-taught, constantly having to up-skill with specialist software due to curriculum area taught

it works'.				digital camera. Need more help with organisation of digital files and technical skills		
22) Do you believe the professional development in ICT that you have used or attended equips you with adequate knowledge to implement ICTs? (Knowledge) a. If no, what additional knowledge is required?	22 yes and no, some professional development provides many practical examples and can be inspiring. Whereas some professional development is really quite useless. Teachers need reminders of what is out there and how you can use it in your class	22 yes, two examples Google earth professional development was very interesting and relevant and OneSchool professional development was useful with finding out information.	22 not totally, I would like to do more pedagogical things and find out what other things are available, I'm up to date with ICT skills, but would like to learn more about pedagogical skills	22 not totally, I need to learn the ICT skills and I have a lot to learn, I need to understand how effective it can be and how I can use it in my classroom, I learn from students, their knowledge is greater than mine in ICTs	22 yes and no, I would get more out of it if it was subject specific and pedagogically based, some professional developments you learn more about the ICT skills but they don't apply to your subject area	22 yes, able to apply it to my subject area
23) Does attending professional development in ICT persuades you to adopt new ICT practices? a. If no, are there other factors that persuade you to adopt ICT practices. (Persuasion)	23 yes, increases motivation	23 yes, increases confidence, encourages me to try new ICTs, feels supported by students and is willing to experiment	23 yes, professional development has opened me up to the LearningPlace by completing the Digital Pedagogical Licence, LearningPlace is useful but time consuming to set up so I haven't made a lot of progress	23 yes, shows me alternatives, pedagogy, researching and organisation	23 yes, it improves it I think	23 yes, at various time probably, have used Prezi that I recently learnt
24) To what degree can you make your decisions about the use of ICT practices or are you hampered by controls outside of your influence? (Decision)	24 yes, but smaller department is limited by funding and less people to contribute to the development of resources	24 yes, set content but flexible pedagogy	24 yes, flexible pedagogy, but will choose what gives students the best outcomes	24 yes, able to make decisions	24 yes, but I consult with HOD and negotiate, in most cases yes if I can justify	24 yes, works within curriculum parameters, but goes outside a bit with pedagogies, for example web2.0 tools that work better than the LearningPlace, does ensure safety for students, chooses these due to efficiency, reliability, ease of use
25) Has your implementation of ICT practices been effective in reaching your teaching and learning goals? (Implementation)	25 yes, can't operate without it	25 yes, cater for self-paced learning and differentiation	25 yes	25 yes, it's very important, but I'm not using it sufficiently	25 yes, use of subject specific equipment	25 yes absolutely, improves outcomes, improves organisation and efficiency, data tracking, tracking students outcomes,
26) What feedback do you receive from students, colleagues or supervisors on your use of ICT practices? (Confirmation)	26 yes, very positive, everyone wants me to share, students very engaged	26 yes, positive from students, I learn from students	26 yes, indirectly, people seem to think I know what I'm doing	26 yes, feedback on overall pedagogies, not specifically on ICT	26 yes, positive from students due to increased communication, supervisors are very good at giving feedback	26 yes, but not separated from other pedagogies or work practices, ICTs allows you to be more professional and this is noticed and acknowledged
Part C - Interview						
1) Describe your preferred type of professional development for learning about ICT practices	1 external presenter, specialist who is helpful, small group	1 Demonstration and practice time, internal presenters, technicians	1 Hands-on, practice time	1 Small group, hands-on, expert presenter	1 Hands-on, trialling in classroom, demonstration and practice time	1 Exactly what we have been doing – hands on, no lectures, demonstration and practice time, internal presenters good for follow-up, smaller groups are better

2) How has attending or using professional development on ICTs impacted on your teaching practices?	2 increases motivation, very positive	2 increases confidence to try new pedagogies	2 increases awareness of new methods of learning, for example LearningPlace is a good resource and allows students increased access to learning resources	2 increases awareness of new methods of learning and classroom pedagogies, have learnt new ways of researching and how to organise files digitally	2 yes it had improved it	2 I have learnt to try new software
3) From the Professional development on ICTs that you have attended or used which one has had the biggest impact on your teaching practice? What was the impact?	3 professional development has resulted in many changes – use of specialist software, iPad, data projector	3 professional development on information literacy and research skills to select information more efficiently, demonstration, practice, hardcopy instructions	3 Probably the Digital Pedagogical Licence professional development as I learnt about new resources, such as the LearningPlace, it showed me different ways of doing things, as I was pretty set in my ways with my specialist software	3 professional development where I learnt about technical and operating software skills, it's important to build currency and keep up with trends, ICTs are part of my subject,	3 professional development on data projectors due to the potential to improve learning outcomes for students	3 professional development was an external conference, able to talk to like minded people, learnt to use Twitter, TED talks, very inspirational,
4) From the Professional development on ICTs that you have attended or used which one has had the least impact on your teaching practice? Why did this occur?	4 professional development with no practical examples or no time to create your own resources	4 professional development that was irrelevant, too basic, all information giving, not hands-on	4 A lot of professional developments are good, it's just finding the time in class to fit it in and finding the time outside of class to develop resources	4 professional development on excel - too high level, poor communication, too many people, confusing, poor presentation	4 professional development that was all information giving, not very useful, poor presentation, didn't make the connection to students, didn't seem relevant, have since conducted own research in this area and have learnt more by myself than what was offered at professional development	4 OneNote - no need, UnitPlanner software quickly superseded by OneSchool, Most professional development has some impact as you generally have a choice about which professional development you go to and you can see if it is any good before you go
5) Have you participated in any professional development in relation to ICT where you have made a decision not to incorporate this into your practice? Why?	5 Facebook - scary due to public nature	5 Prezi - thought it was too complicated, took me a while to see the relevance and see how it could work, have since realised it isn't that bad and have used it	5 No	5 Prezi - couldn't see the advantage, not a priority	5 nothing that I can think of	5 OneNote - no need or benefit, Any professional development that doesn't give me something to think about after I've left, I need interactive professional development, with outcomes for learning
6) Identifying the professional development that you have most regularly used or attended (from the questionnaire), is there an alternative professional development type that you would prefer to use or attend.	6 Language lab Content specific, During school time, Short and concise	6 Happy with choices	6 Engaging with presenter is good	6 More follow through, need to learn in stages	6 I access professional development outside of school by being connected though professional associations	6 Skype, I like learning via Twitter at home, can see other people's resources
7) What motivates you to attend professional development on ICTs ALREADY ASKED PART B Q 9)	7 Pressure to stay in front/relevant, pressure from external colleagues	7 Genuinely interested in technology, sees a personal connection	7 Sees a benefit for students	7 Genuinely interested in technology, sees it as essential for being an effective teacher	7 improves my teaching, makes it more interesting and engaging for students	7 Genuinely interested in technology, sees a personal connection, iPad, improves efficiency
8) Do you intend to continue to learn about ICTs in future?	8 Yes	8 Yes	8 Yes	8 Yes,	8 Yes, want to learn more about the data projector	8 Yes, I can't not
9) Where does ICTs professional development place	9 First	9 Third after leadership and curriculum	9 Ranks highly given it is enjoyable, can't do too much	9 very high, I recognise this is my weakness, kids are so	9 one of my top priorities, general interest area	9 High as long as it fits in with ASoT, self-taught

in relation to your other professional development priorities?			at once	savvy, don't like Facebook or blogs, pace of change is overwhelming, many people have too many devices, doesn't see the point		
10) Have you encountered any obstacles or barriers that have prevented the outcomes from professional development on ICT from being implemented?	10 Access and technical issues	10 Other priorities, Funding, iPad	10 Finding relevance	10 Other priorities	10 Funding, time, work life family balance, technical issues	10 Time, technical issues, funding, competing priorities,
11) Do you receive adequate follow-up and support from others after attending professional development?	11 Not always	11 External - No, Internal - Yes	11 Yes adequate	11 No, I don't think so	11 the offer is always there, but sometimes other priorities arise after the professional development is finished	11 You have to ask for it, not readily offered

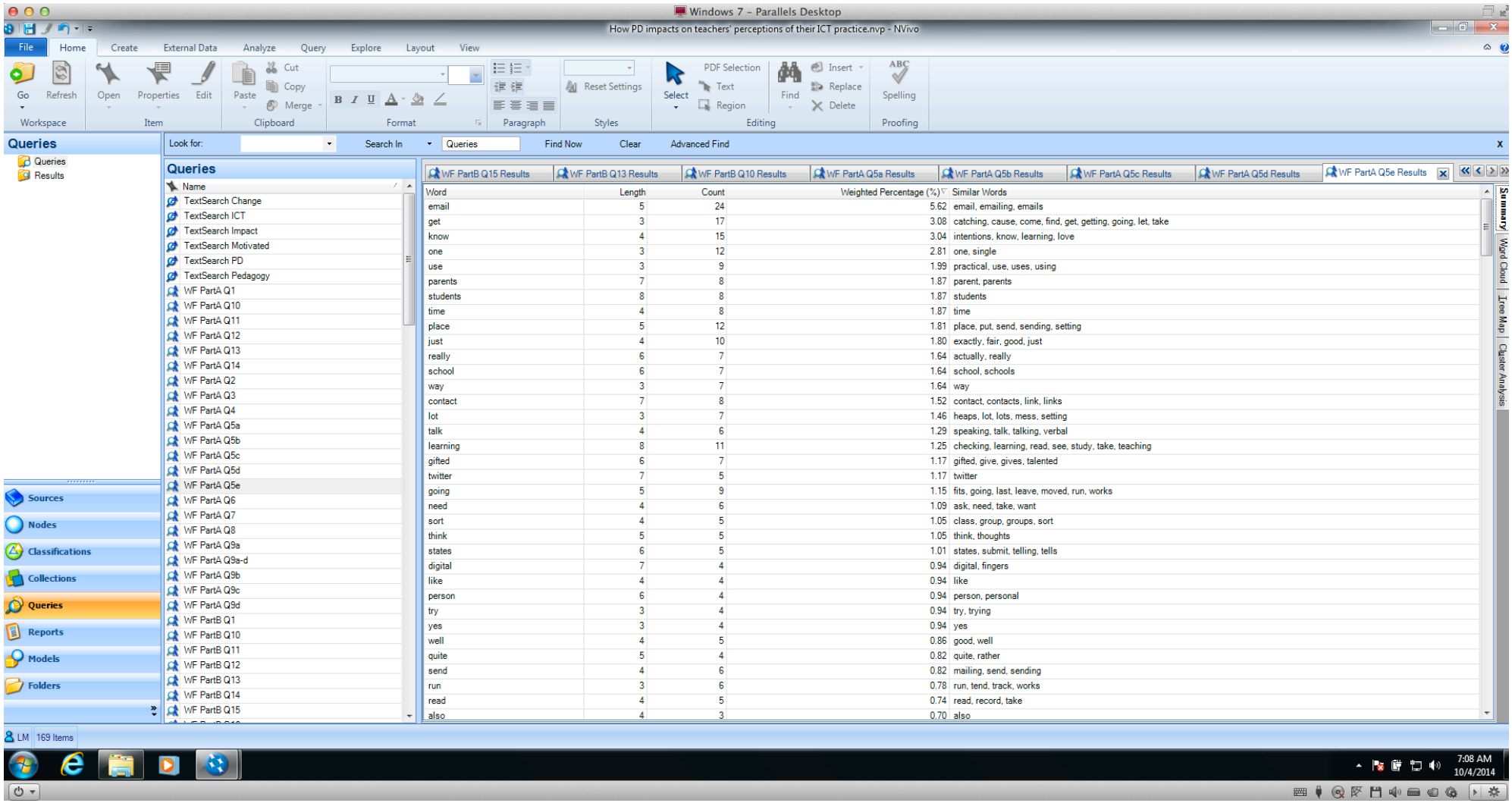
Appendix E: Underutilised types of professional development



Appendix F: Difference between frequency and impact

Types of professional development	Part A - frequency	Part B - impact	Difference (frequency - impact)
6. Structured online course	1.25	3.40	-2.15
14. Formal observation of another colleagues' practice e.g. Viewing room	1.31	2.75	-1.44
23. Social media - e.g. Twitter or Facebook	1.44	2.00	-0.56
5. External course or workshop	1.44	3.17	-1.73
4. Conference	1.50	2.70	-1.20
7. Online learning via EQ resources - e.g. Learning Place, Atomic Tutorials, iConnect etc	1.56	2.43	-0.87
15. Informal observation of another colleagues' practice e.g. team teaching	1.69	2.50	-0.81
16. Professional learning networks – e.g. either online or face-to-face but involve colleagues outside of your primary location	1.88	2.67	-0.79
17. Resources obtained from professional association memberships	1.88	2.71	-0.84
12. Peer mentoring from school technicians	1.88	2.92	-1.04
9. Learning from your direct supervisor e.g. Head of Department or Deputy Principal	1.94	2.00	-0.06
13. Books or other print references	1.94	2.45	-0.52
11. Peer mentoring from colleague in other faculty	1.94	2.67	-0.73
3. Small group – e.g. school-based workshops, student free day professional development sessions, faculty organised sessions etc	2.50	2.93	-0.43
1. Domain meetings where colleague/s led a session on ICT practices	2.63	2.38	0.25
8. Informal online learning through tutorials or other resources – e.g. YouTube, Khan Academy etc	2.69	2.58	0.10
2. Staff meeting where colleague/s provided information or a demonstration of ICT practices	2.75	2.44	0.31
22. Emails or mailing lists	2.75	2.50	0.25
20. Learning from students	2.81	2.50	0.31
10. Peer mentoring from colleague in own faculty	2.81	2.73	0.08
19. Learning from family or friends	3.13	3.07	0.06
18. Personal use at home	3.38	3.13	0.25
21. Self-taught trial and error	3.50	3.13	0.37

Appendix G: NVivo Query Search



Appendix H: Manual Coding of Text

2) Do you believe the leadership and senior management of the school promotes the use of ICT implementation?	Yes I do, I do. I think the way at staff meetings and faculty meetings, you see the HODs and Admin team using ICTs effectively and using that as a tool to further the learning of staff and i think that actively says to staff, well, this is what ICTs are about in aiding processes and it's about using them to further a motive rather than putting it on.	I think so yes, yes i think well they certainly a few of them promote it at friday briefing and staff meetings and informing us of what we can do with OneSchool and what we can do with reporting and what we can do with - that might be about it. They are evolving too.	They do but it's very specific and that's in data. I think the school is fairly data driven and i think we are encouraged to you know, look at our classes and have a look at NAPLAN and have a look at Strengths and weaknesses, do your differentiation and get to know your students. There is the viewing room, but that's not ICT either. No i don't see in terms of pedagogy and honestly there is probably, there is a few of them and i don't think they are with it either, for those of us who are older, i don't think ICTs do come naturally. I know there are readings and that sort of thing, so that's encouraged and research, which we are encouraged to look at researchers and their findings, which are readily available online rather than buy the book, but i don't think so.

Appendix I: Thematic analysis of verbs

Verbs	Major use – number of times this verb appeared in a focus area statement that was identified to be a 'Major use of ICT'	Moderate use - number of times this verb appeared in a focus area statement that was identified to be a 'Moderate use of ICT'	Minor use - number of times this verb appeared in a focus area statement that was identified to be a 'Minor use of ICT'	Number of times each verb appears across all 27 focus area statements
Implement	1	5	1	7
Design	1	2	1	4
Use	1	2	-	3
Select	1	2	-	3
Develop	-	3	-	3
Apply	-	2	-	2
Establish	-	2	-	2
Plan	-	1	1	2
Provide		1	1	2
Create	1	-	-	1
Report	1	-	-	1
Organise	-	1	-	1
Structure	-	1	-	1
Set	-	1	-	1
Review	-	1	-	1
Evaluate	-	1	-	1
Ensure	-	1	-	1
Understand	-	1	-	1
Participate	-	1	-	1
Manage	-	-	1	1